



JOINT INSTITUTE FOR NUCLEAR RESEARCH

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**CURRENT RESEARCH PROGRAM
OF THE LABORATORY
OF COMPUTING TECHNIQUES AND AUTOMATION**

Report to the 81th Session
of the Scientific Council of JINR
January 16—17, 1997

Dubna 1996

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Физический институт
основных исследований
БИБЛИОТЕКА

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Having in mind the wide field of research, as well as the world-wide collaboration of JINR, its networking, information and computing infrastructure has to meet the needs of the Institute's research programme in computing, information and program resources and at the same time to be an element of the worldwide information system providing the integration of JINR and its Member State institutes into the worldwide scientific community. Another essential problem is to supply theoretical and experimental investigations with new methods, algorithms and programming systems, intended to increase the research efficiency and to reduce the time of experimental data processing.

From this point of view there are two Priority Fields of Scientific and Technical activity at LCTA:

- development of the JINR networking, information and computing infrastructure;
- development of methods, algorithms and codes to investigate the computational and mathematical physics problems for research under way at JINR.

It is obvious that for an active and fruitful international cooperation of JINR, an advanced network and computing development at JINR is required. Despite a number of objective difficulties networking, computing and information infrastructure operation and improvement have been provided during 1996.

More than 150 papers were published in 1996 in leading scientific journals, proceedings of conferences and in the form of preprints. Two International conferences were organized:

- ♦ 17th annual meeting of TeX Users Group "TUG'96" was held in Russia for the first time (*Dubna, July 28 - August 2, 1996*);
- ♦ 9th Conference on Computational Modeling and Computing in Physical research (CMCP'96) was held to honor M.G. Meshcheryakov, the famous scientist and the founder of the Laboratory of Computing Techniques of JINR (*Dubna, September 16-21, 1996*).

To date the most physical experiments with film data output were over at JINR and due to the JINR Directorate decision the film data measurements on several computer controlled scanning and measuring devices (HPD, PUOS-Samet) were closed and the film data processing in LCTA was finished in 1996.

In the field of information and networking infrastructure of JINR the main tasks are

- upgrade of the JINR local network by improving its topology and applying modern networking technologies for operation control and monitoring;
- creation of an integrated soft and hardware environment, joining central and local servers, workstation clusters, X-terminals, PCs and other computing equipment;

- creation of an unified information environment of JINR and its Member State institutes based on WWW-servers;
- participation of JINR and its Member State institutes in worldwide distributed computing systems;
- participation of JINR and its Member State institutes in joint work to create Data Base applications by using the ORACLE-WWW gateway;
- information, algorithmic and software support of JINR and its Member States research programmes.

1. INFORMATION AND COMPUTING INFRASTRUCTURE AT JINR

In 1996 the traditional upgrading of the JINR Computer Complex has been in progress. Presently the JINR central servers include:

- a cluster of integrated vector - parallel computers CONVEX-220 and CONVEX-120;
- a cluster of VAX-8800 two-processor computers;
- an IBM-4381 computer;
- a distributed cluster of stations based on SUN Sparc20;
- a DEC Alpha 2100/266 information server for BAFIZ-96;
- a NICE server.

A CISCO-router as well as specialized servers based of SUN Sparc, VAX, PC 486 and Pentium are used for communication channels maintenance, as well as for network, file and information service.

In May-September 1996 the central processor units of ES-1066 have been replaced by IBM-4381. While replacing the units, the users' work was not interrupted. The replacement of the ES computers by IBM techniques was caused by constant requirements of the Institute laboratories upon the VM-service.

The replacement of ES computer devices with IBM devices:

- ⇒ decreased the electric power consumption (more than 60 KW) ;
- ⇒ expanded the memory up to 40GB at the expense of connecting the IBM disks to the IBM processor;
- ⇒ increased by a factor of 1.2 the computing power of the system.

Besides, the possibility to work with magnetic tapes and access to the ETHERNET network remains. The development of the VAX-cluster for the maintenance of the VMS-service was in progress. All this work were done without additional financial support.

2. COMPUTER NETWORK AND COMMUNICATIONS

Main results in 1996

- Throughput of the INTERNET network has been upgraded up to 128 Kbit/s. Proposal of further upgrade of the throughput up to 2 Mbit/s have been worked out.
- Total traffic of the information exchange between JINR and the world is about 2 Gbyte/day.
- A fibre optic line between JINR and SCS-2 (passing thorough the International University "DUBNA") has been built for connection to the high-speed channel Moscow - SCS-2.
- Creation and modernization of the Institute local area network in buildings housing the JINR Board and the JINR Conference Hall have been performed; modern technology has been used (fibre optic cable between the buildings, intellectual HUB's and "twisted pair" cable inside the buildings).
- The basis is ready for connecting other institutions to the JINR network. Several connections have been already performed.
- A modem pool has been designed for JINR users (with help of the terminal CISCO-router) for access to the JINR infrastructure resources and networking services.
- A service of JINR Network Operation Centre, performing:
 - ⇒ maintenance of the JINR network user base;
 - ⇒ information support using the WWW-server;
 - ⇒ consultations for users;
 - ⇒ coordination of the network managers' work in the Institute subdivisions;
 - ⇒ routing, DNS, postmaster service
 has been created.

Currently the JINR network looks like a clearly defined star-type structure centered in LCTA (Fig.1). The network backbone comprises a central concentrator connecting practically all JINR laboratories by a fibre optic cable. Consequently, the FDDI technology is not suitable for it, as it requires a ring structure. The use of Fast Ethernet with the 100Base-T

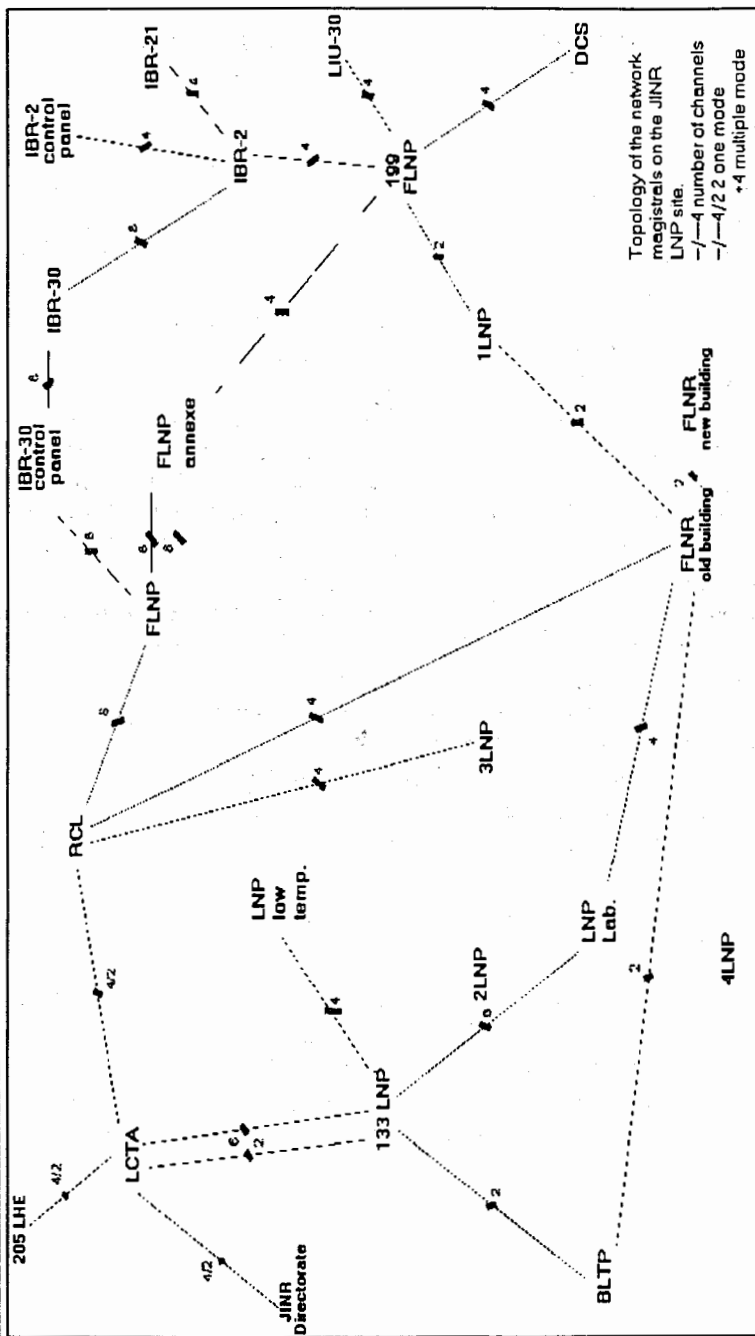


Figure 1 Topology of the JINR network (backbone) inter-laboratory segment.

and 100VG-AnyLAN standards is retarded by non-abundance of optic adapters for Fast Ethernet and impossibility of further integration of telephone- and video- services into the network. This issue has become actual recently. Considering the wide range of ATM devices on the network communications market and the needs of the JINR network, the use of ATM seems to be the unique, reasonable and promising trend in developing the JINR network infrastructure. The possible ATM topology at LCTA is shown in Fig.2.

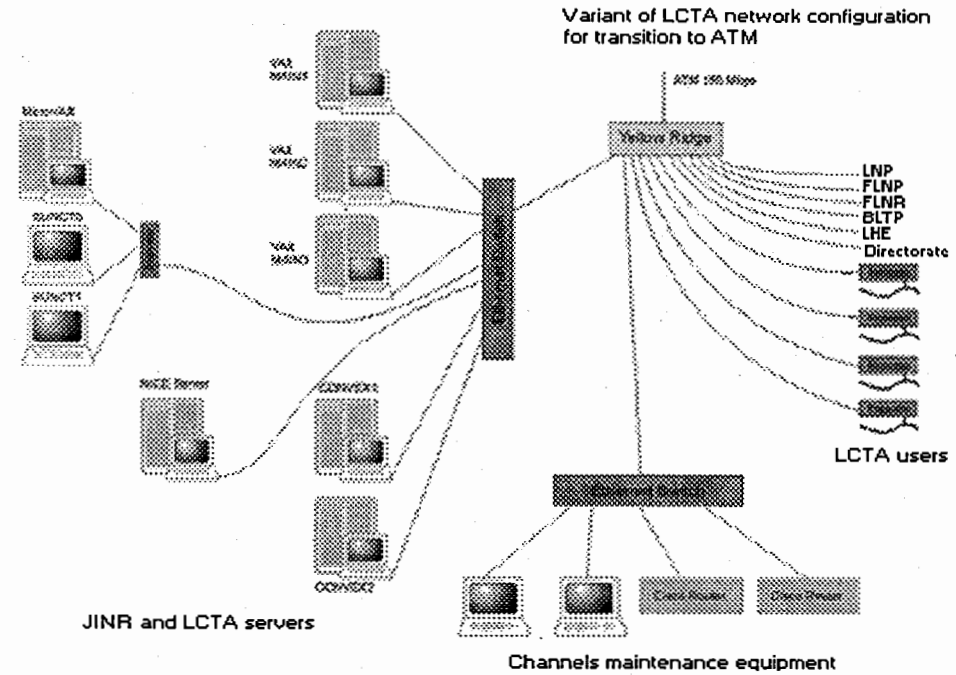


Figure 2. Variant of LCTA network configuration for transition to ATM.

A possible topology of the ATM-backbone at the JINR LNP-site is shown in Fig.3.

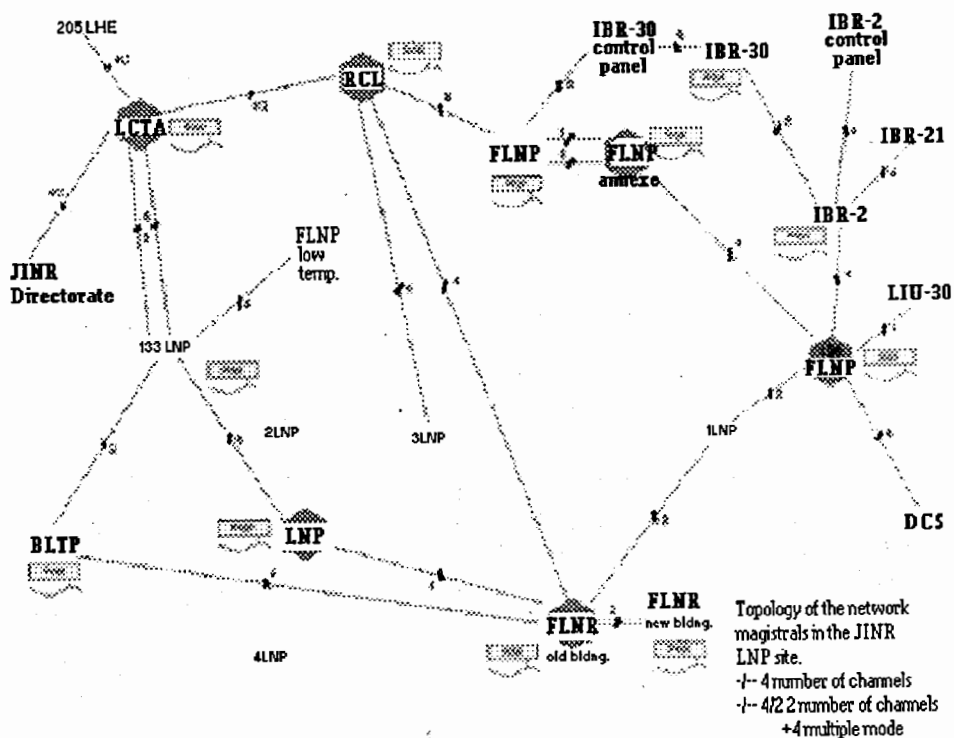


Figure 3. Network topology with ATM switches at the JINR LNP-site.

3. SOFTWARE

I. By agreement with CERN, preparation of a formal version of 96a CERNLIB for the WINDOWS NT and WINDOWS 95 operating systems, participation in the RD47 project on introduction of the Windows NT operating system for HEP problems and creation of the programming system ROOT for LHC experiments have been accomplished. A new version of the LabVIEW software has been installed, tested and maintained at CERN and JINR. LabView applications and libraries are upgraded and tested for new version of Lab-

View (ver.4.0) for Windows 95 and NICE95. The WWW-based information support for LabVIEW users was implemented. The LabVIEW library developed for the Dubna PC-CAMAC interface KK009 is prepared to be available on WWW.

- II. Development of program libraries (the linear algebra complex has been put into use), adaptation of the last CERNLIB version have been done.
- III. A project for HEP environment on UNIX-platforms has been developed and its realization has begun.
- IV. Projects for CMS and ATLAS computing at JINR have been developed. Algorithms for the second level muon trigger of the ATLAS LHC experiment have been developed. Algorithm modeling and tuning using ATLSIM (DICE93, ATRECON) has been done. Algorithms for P_T computation in trigger conditions with computed magnetic field and new geometry have been developed. (Alexandrov I.N., Kotov V.M. et al. In. Proc.ACS'96, 1996). Algorithm program provision for work in autonomous regime has been elaborated. Methods for trigger algorithm creation have been proposed in convoy computing conditions using modular algebra methods and programmed logical integral technologies (FPGA). Processing and modeling of high-speed combinatory switches has been accomplished using the FPGA technology for the muon trigger prototype. A model of physical processes in a cathode-strip chamber has been developed. Programs have been created for processing the experimental test calibration data from trajectory detectors including the mentioned chambers. The programs for modeling and processing a complicated integrated test, whose main feature is a simultaneous work of prototypes of calorimeter and track detectors, have been designed. Applying the developed programs for recognition, identification, determination of the events parameters and statistical analysis, some characteristics of the physics processes of particles passing through heterogeneous media have been received; estimations of energetic resolution of the calorimeters under various conditions, mutual effect of the setup's components to such operational features of detectors as efficiency and accuracy, have been received. Architecture, mathematical and software support has been developed for a parallel scaleable system for mass data processing in experiments on particle physics (the PARIS system). Modern algorithms based on artificial neural networks have been created and used for experimental data processing.
- V. SITE-licenses were purchased for FORTRAN and C++ on the SUN SOLARIS platform. Licenses for WINDOWS NT-server and program products for WINDOWS NT/95 under NICE were purchased.
- VI. Maintenance of the NICE server for JINR users:
 - provision of its permanent operation;
 - improvement and modifications of the NICE environment;

- preparation of NICE95 introduction in JINR;
 - CERN NICE95 documentation was located on the OraDBI server, accessible for JINR users;
 - the server DEC Prioris XL is available, the operating system Windows NT Server has been installed;
 - some licensed program products have been purchased for the NICE environment.
- VII. A Web - Oracle gateway ORALink has been adapted for the Digital Unix platform on the Alpha processor server. By agreement with FZ-Rosendorf (Germany) this gateway has been installed under AIX operating system and the application for Rosendorf Scientific Library DB was developed.
- VIII. Maintenance of various codes of the Russian language in the WWW environment has been developed and installed for the BAFIZ server.
- IX. A number of physicists' programs have been transferred from the CDC machine to CONVEX, VAX and PC. During the work the lost initial texts of the programs have been restored and extraction of programs and data from magnetic tapes of the ES and CDC machines was done. That was quite a laborious and nontrivial job. To simplify the process, special tools were worked out. The tools could be used in applied programs for 'direct' data input from old magnetic tapes.
- X. By agreement with FZ-Rosendorf and FLNR the work on visualization of experimental data by using AVS and IDL for experiment CORSET was performed.

4. INFORMATION SUPPORT

Stable day-and-night access to all free international data bases and international information systems WWW, Gopher, Wais and Archie has been provided through the JINR LAN and its external computer communication links to INTERNET and national networks connected to INTERNET. The data bases and information systems mentioned above include both the general-purpose data bases containing information on science, technology, education and culture and specialized data bases storing the information (for example about the LHC experiments and other projects). They also represent bibliographic data of the JINR Publishing Department, full text systems (for example, the archive system of electronic journals published by the international centre - Institute of Physics Publishing), bases for design and engineering work, etc. The LCTA personnel responsible for the main WWW-server at JINR and the basic LCTA server, jointly with the personnel of other JINR laboratories responsible for information support have improved essentially the possibility of references to resources of

local and external servers (see "LCTA Information Bulletin", No.41).

However, a number of bibliographic and factographic data bases such as INIS and PPDS (access has been provided by the tools agreed with IAEA (Vienna), IHEP (Protvino) and LBL (Berkeley)) remain outside access via WWW. A way of connecting the mentioned type of bases to the information system WWW has been worked out in frames of the application of the database system technology to solving of experimental and theoretical physics problems. Within the project BAFIZ-96 a new information server provided with WWW software, DBMS ORACLE and an interface have been put into operation.

Maintenance and development of hard and software support of the program complexes "Financial account of accountable personnel", "Banking operations account", "Wages calculus and summaries", "Account of material values and its initial documentation on the basis of data base distributed processing within the JINR LAN", as well as development of software for the Institute Library and its users, according to methods analogous to those in the project BAFIZ-96, have been carried out jointly with the Automated Management Systems Department of the JINR Managing Board.

5. COMPUTATIONAL PHYSICS

Works in area of Computational Physics were continued in 1996. About 150 articles were published and accepted by international journals.

Mathematical Modeling

Aiming to improve the current Monte Carlo cascade-evaporation model of high-energy interactions of particles and nucleus, a systematic comparison of this model with experimental data has been fulfilled (*V.V. Uzhinskii, et al. Yad.Phys., 59, 109, 1996*). A code for the modeling of multi-fragmentation processes in high-energy nuclear collisions is developed (*V.V. Uzhinskii, S.Yu. Shmakov et al. E1-96-50, Dubna, 1996*).

A Monte Carlo code for modeling of particle and ion transport in sectioned ("ventil") subcritical electro-nuclear systems is created. A possibility to essentially increase the neutron yield has been shown (*V.S.Barashenkov, A. Polanski, A. N. Sosnin, V. P. Filinova. JINR E2-96-211, Dubna, 1996. V.S. Barashenkov, A. Polanski, A.N. Sosnin. JINR E2-96-176., Dubna, 1996*). Using C/C++ and the library Zinc Application Framework, a code for mathematical modeling of transport of liquids in three-dimensional media with an arbitrary heterogenous geometry is developed. A Monte Carlo code is also created for such problems.

The modified version of the ECIS code is applied to the analysis of the

reactions with nuclear radioactive beams. Both quasielastic scattering angular distributions and total reaction cross sections at different energies are under consideration. Coupled-channel computations have been performed for the elastic scattering of light exotic nuclei on stable target-nuclei (O.M.Knyazkov, A.A.Kolozhvari, I.N.Kuchtina, S.A.Fayans. *J.Nucl.Phys.*, 59(1996)466. S.A.Fayans, O.M.Knyazkov, I.N.Kuchtina, Yu.E.Penionzhkevich, N.K. Skobelev *J.Nucl.Phys.*, 59(1996)1188).

Calculations were performed in connection with research on resonance phenomena in subatomic physics (development of automodelling and similarity principles, research in effect of the form of the potential and the sort of boundary conditions to the resonance hadron decays), (Gareev A., Kazacha G., and Ratis Yu. *PhEPAN* 27(1996) 97-172).

Computations have been performed within a quasiparticle photon model of reduced probabilities of M1 and E1 jumps in the odd deformed nuclei (Soloviev V., Sushkov A. and Shirikova N. *Nucl.Phys. A660* (1996), 155) as well as computations of distribution of the force of E1 and M1 jumps in ^{238}U . A review was made on low falling nonrotational states in deformed nuclei of the rare earth elements (Soloviev V., Sushkov A. and Shirikova N. *PhEPAN*, 27,6(1996)).

Based on deterministic and stochastic approaches, the nonlinear effects of condensed systems and nonequilibrium adsorption phenomena in an adsorbate-adsorbent open system were investigated (Kholmurodov Kh.T., Fedyanin V.K., Puzynin I.V. *Accepted Jour. Phys.Chem.* 1996).

The calculations of the fine and hyperfine splitting of the energy levels of antiprotonic helium, $\bar{p}\text{He}^+$ in states with orbital momentum $30 \leq l \leq 40$ have been performed on the basis of adiabatic approach improvement (Bakalov D. Puzynin I.V. et al. *Phys. Lett A*, 211(1996)223-227).

Computer Algebra

Improvement of algorithms for transformation of systems of nonlinear algebraic equations into canonical involutive form and for construction of finitely presented Lie algebras and superalgebras was done (Gerdt V.P., Korniyak V.V. *Journal of Symbolic Computation*, 21 (1996) 337-349).

The pioneer computation of the forth-order coefficient in heat-kernel expansion of non-minimal pseudo-differential operator in curved space and in the presence of gauge fields was successfully performed. This is of importance in quantum gravity and in Yang-Mills theory.

The normal form of Birkhoff-Gustafsson was computed for the Hamiltonian system with degeneration, describing two-dimensional unharmonic oscillator.

A Baecklund transformation for the Landau-Lifshits equations was found for the first time (Robuk V.N. *Preprint JINR P5-96-216*, 1996). An algorithm was designed for computation of Feynman integrals singular at zero momenta, and a new kind of recurrence relations for Feynman diagrams was obtained (Fleischer J., Tarasov. O., to appear in *Nucl.Phys.B*).

Nonlinear models in theoretical investigations

A new string model for quark forces in QCD in which the stiffness of QCD strings is negative has been suggested and investigated completely. In this model all consistency problems of an earlier rigid string are absent, while attractive properties are preserved. For small to moderate temperatures the temperature dependence of the effective string tension and an approximate deconfinement temperature have been derived (H. Kleinert, A.M. Chervyakov, *Phys. Lett. B381*, 286 (1996)).

The two-dimensional planar ferromagnet model in deformed matter has been represented as a topological Chern-Simons gauged model. Their reductions on the symmetric spaces have been described. Some class of the exact quantum solutions and the statistical transmutation of topological solitons into anyons have been obtained.

The critical behavior of an Abelian sandpile model as a self-organized branching process and the critical exponents have been studied. The statistical distribution in a stochastic traffic model with disorder have been obtained (V.B. Priezzhev, D.V. Ktitarev, E.V. Ivashkevich, *Phys. Rev. Lett.* 76, 2093 (1996)).

Numerical methods and algorithms

Newtonian iterative scheme with simultaneous iterations of inverse derivative for the numerical solving of nonlinear problems is suggested (Airapetyan R. and Puzynin I.V. *Preprint JINR*, issued for journal "Comp.Phys.Comm").

It was suggested a new formulation of the inverse problem of quantum scattering theory about a reconstruction of potential over the phase shift values on the family of segments in (l,k)-plane (Airapetyan R., Puzynin I.V. and Zhidkov E.P. *Preprint JINR*, Zhidkov E.P. and Airapetyan R.G. *News of Moscow University Ser.1, Mathematics, Mechanics*, 1996, No.6).

Based on path integral approach, the algorithm for studying of the thermodynamic characteristics of the quantum systems with a large number of identical particles has been suggested (Lobanov Yu., Shahbagian R., Zhidkov E.P. *J.Comp.Appl.Math.*, 70(1996), 145-160).

The numerical approach for study of the 3D-nonlinear polaron problem for a finite constant of coupling has been suggested (P.G. Akishin, I.V.Puzynin, Yu.S.Smirnov, *Lecture in Applied Mathematics*, 32,1996).

The boundary value problems and algorithms of its numerical investigations have been developed for the quantum field deuteron model with the scalar and pseudoscalar mesons interactions. The algorithms with corresponding software for numerical study of light and heavy quarkonia model, binucleon model, acoustic lasers have been created (*I.V. Amirkhanov et al. Preprint JINR P11-96-268, issued for J.Math. Modeling.*)

Numerical study of boundary value problems has been performed for high-order equations with a small parameter at a higher derivative. The robust and asymptotically optimal methods for solving elliptic equations with highly anisotropic coefficients and the Navier-Stokes equation have been developed with application to problems in structural mechanics, porous media, incompressible flow (*B.N.Khoromskij, G.Wittum, Numer.Math., 73(1996) 449-472.*)

New methods and models for some data processing systems

Algorithms of track recognition detected by a system of drift tubes in the magnetic field for experiments EVA/E-850 and ATLAS were developed (*Baginyan S.A., Ososkov G.A., Panebratsev Yu.A., Shimanskiy S.S., Comm. JINR, E10-96-263, Dubna, 1996*). The original method for circles separation in RICH detectors tested on model and real data of the experiment NA-45/CERES is suggested (*H.Agakishiev, G.Ososkov et al., Nucl. Instr. and Meth. A371 (1996), 243-247*). The method for separation of two overlapping gaussian-like distributions was developed (experiments CERES, STAR).

Within the LCTA-LNP cooperation on the DIRAC experiment, prepared at the PS accelerator in CERN, a program for modeling the physical setup GEANT-DIRAC has been designed. The code includes an event reconstruction program and can be realized for different variants of the installation geometry in the form of interactive- or batch-version. In July 1996 the first formal version of the program GEANT-DIRAC, version 1.00/00, was accepted as a collaboration program. The effect of the background on the loads of different detectors has been estimated. Results are presented in the experiment project, as well as in a number of the working documentation of the collaboration. Besides, the investigations related to the design of a third level neural network trigger for the DIRAC experiment are performed together with the University of Basel.

The method for rare events extraction from the dominated background by help of artificial neural network has been developed. The algorithms for identification of events with secondary vertex and for extraction of tracks composing it have been developed for the EXCHARM spectrometer. (*Bonyushkina A.Yu., Ivanov V.V. et al. JINR Rapid Communications, 1996, 5[79]-96, 5*)

The cellular automaton model for recognition of straight parts of tracks detected by the EXCHARM spectrometer is constructed. The algorithm for vertex searching in multiparticle events based on the elastic neural network for the NEMO experiment has been developed. The program for

demonstration of cellular automata and neural networks applications to the solving of physical problems has been created (*M.P.Bussa, L.Fava, L.Ferrero, A.Grasso, V.V.Ivanov, I.V.Kisel, E.V.Konotopskaya and G.B.Pontecorvo, "Nuovo Cimento", 109A, 3, 327-339 (1996)*). Four Java Applets for the NEMO experiment JINR home-page and for cellular automata demonstration programs have been developed (<http://nuweb\LNP\NEMO\vertexN.html>).

Magnetic field computations

3D magnetic field expert computations have been performed for the ALICE experiment (*P.G.Akishin, A.S.Vodopianov, I.V.Puzynin, Yu.A.Shishov, M.B.Yuldasheva, O.I.Yuldashev. ALICE 96-06, Int. Note/Mag, 4 April, 1996*). The first computational results concerning the magnetic system in the L3 magnet, the dipole magnet, muon filter and its mutual influence have been presented.

For the EXCHARM experiment the investigation of 3D aperture magnetic field dependence on the coil current value has been carried out. Numerical optimization of actively screened dipole magnet coil geometries has been performed. Fast multilevel algorithms based on multipole expansion of the integral operator kernel was constructed for coil 3D magnetic field calculations.

Coil geometry with strong screening has been obtained (*A.V.Fedorov, I.A.Shelaev. JINR Rapid Comm. 6(96), accepted*). Magnetic field calculations have been done for the STORS, EXCHARM, CRION-C magnets.

6. PARTICIPATION IN UC DEVELOPMENT DURING 1996

Traditionally LCTA take part in JINR UC development. In 1996 the following work were performed:

- Computers maintenance at the JINR UC under the DOS + NICE + WINDOWS95 operating systems.
- Maintenance of the UNIX server.
- Modernization of the computer techniques and operating systems:
 - ⇒ - WWW server installed on a UNIX computer to organize a WEB page for the JINR UC;
 - ⇒ - WEB page of the JINR UC has been created;
 - ⇒ - Lecturer's workplace in the UC Conference Hall was modernized;
- To date a project of modernization of the UC computer complex is complete (see fig.4).

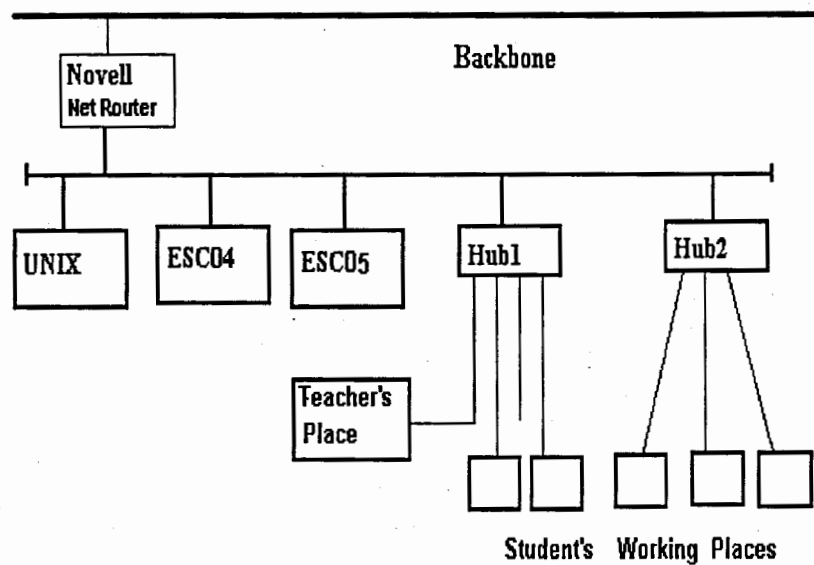


Figure 4. The scheme of UC network structure.

7. PROJECT BAFIZ-96

JINR Member States organizations had always in minds, that creation of "common information space" was one of the most important problems, but up to 1995 we had no mutual special official agreements or projects as parts of our local plans. At last, in 1995 representatives of seven Institutes located in Russia signed the document named "Project BAFIZ-96" (Russian-type abbreviation for "Bases for Physics"). This set of Institutes included JINR (with a leading role), Institute of High Energy Physics (IHEP, Protvino), Institute of Theoretical and Experimental Physics (ITEP, Moscow), Institute of Nuclear Research (INR, Troitsk), Institute of Nuclear Physics of Moscow State University (INP MSU), St.Petersburg Institute of Nuclear Physics (PINP) and Institute of Nuclear Physics (INP) in Novosibirsk. According to this project, the backbone created is a subnet of WWW-servers, where the software of each server has a gateway between WWW and relational DBMSs compatible with ORACLE (original ORACLE or INFORMIX, for example); the operating system could be UNIX or WINDOWS/NT. One of the high priority tasks is creation of new physics

data bases (DB) in the WWW-ORACLE environment and adaptation of the existing mostly used databases to this environment. An example of new DB is "Accelerators in Russia", which provides access to information about accelerator systems by queries on various parameters concerning technique and accelerator physics, as well as on existing software modelling packages. It is based on published materials and describes:

- Proton and electron high energy complexes;
- Projects of linear colliders;
- Projects of B-factory;
- High current accelerators of protons and positrons;
- Heavy ion accelerators ;
- Synchrotron radiation sources of third generation;
- Superconducting resonator in large electron accelerator complexes;
- Projects of radioactive beams accelerators.

Such a DB is proposed to be an addition to existing computerized information for accelerators and software in foreign physics research, such as FNAL (<http://dosgio.fnal.gov/~maiorov/tcode.html>) and LANL (<http://www.atdiv.lanl.gov/doc/laacg/misc/acclist.html>).

Following the list of intents of the Institutes involved in the BAFIZ project are responsible for information collection about experiments which are or will be running on their installations, such as Nuclotron (in LHE of JINR), Pulsed Neutron reactors IBR-2, IBR-30 and IREN (in FLNP of JINR), complexes of heavy ions (in FLNR of JINR), accelerators in IHEP, Moscow meson factory, synchrotron radiation sources in INP (Novosibirsk). All of these institutes have to open their electronic libraries (bibliography and full-texts), special databases, such as cosmophysics experimental DB's in INP MSU, free software archives. The described BAFIZ jobs started and, for example, information concerning accelerators in Russia may be taken from the HTML-article "Physics Information Servers and Data Bases" via the link to INFO from the www.jinr.ru server Home Page:

<http://www.jinr.ru>

<http://cv.jinr.ru/info.html>

<http://cv.jinr.ru/~nikonov/phbd.html>

It is necessary to mention that the BAFIZ-96 project is supported by the governmental Russian Fund for Fundamental Research and by the Russian Academy of Science. We are expected to try to involve other JINR Member States institutes in BAFIZ-like jobs.

8. GUIDELINES FOR 1997

- Development of the multilevel local network at JINR. Creation of the Institute Backbone based on fast network technology. Introduction of tools for control and monitoring of the JINR local network operation (HP OPEN VIEW).
- Development of JINR external communications. Upgrade of the JINR computer communication link to the outer world up to 2Mbit/sec. Look into questions related to the development of communications in JINR Member State institutes.
- Centralized maintenance of the Common Unix and X Terminal Environment (CUTE) architecture, WINDOWS-95 and WINDOWS NT at JINR. Software standardization and maintenance of the program archives.
- Development of JINR information and WWW-servers. Centralized maintenance of the DBMS ORACLE data bases. Creation of applications of the data bases to various Institute's activities (JINR administration and JINR Library data bases; Publishing Department; physical data bases.)
- Algorithmic and software support of the research program of JINR and JINR Member States.
- Continuation of joint research in the field of experimental data visualization.
- Development of methods and tools for parallelization of complicated computational problems and data processing systems.
- Work on creation of Data Base applications by using the ORACLE-WWW gateway.
- Development of mathematical methods, algorithms and software for:
 - * research on multidimensional localized solutions to the nonlinear dynamical equations;
 - * numerical investigation on dynamics of complicated systems in nonlinear quantum field models on the basis of the newtonian iterative schemes;
 - * investigations of nonlinear integro-differential equations describing heavy ion collisions as composite objects at finite temperatures and densities of nuclear matter, polaron dynamics in polar molecular clusters and interactions of powerful pulsed ion beams with material samples;
 - * magnetic field calculusfor investigations under way at JINR
- Fast algorithms design for simulations of nuclear cascades in heterogeneous fissile media. Mathematical modeling of damages of irradiated biological tissues and HTSC materials.

- Extraction of rare processes using cellular automata, artificial neural networks and nonparametric statistics.
- Development of computer-oriented methods and software for constructing explicit solutions to the nonlinear evolution equations by using the computer algebra languages.
- Design of applied program packages for solving nonlinear problems in experimental data mathematical processing.