Networking, Computing, Computational Physics

JINR's Computer Centre

09-6-1048-2003/2007	Priority: 1
	Status: In-progress

Information, Computer and Network Support of the JINR's Activity

Leader from JINR: V. Ivanov, V. Korenkov, P. Zrelov

Participating countries and international organizations: Azerbaijan, Armenia, Belarus, Bulgaria, CERN, Czech Republic, Germany, Georgia, JINR, Moldova, Mongolia, Poland, Russia, Romania, Slovak Republic, the USA, Uzbekistan.

The main task of the Laboratory of Information Technologies is to provide present-day telecommunication, network and information resources for the theoretical and experimental research conducted by JINR Member States on the basis of JINR and other scientific centres.

In order to solve this task successfully, it is necessary:

- to provide JINR and its Member States with high-speed telecommunication data links;
- to create a high-speed, reliable and protected local area network (LAN) of JINR;
- to create and maintain the distributed high-performance computing infrastructure and mass storage resources;
- to provide information, algorithmic and software support of the research-and-production activity of the Institute;
- to develop the JINR GRID-segment and provide its connection to the European and global GRID structure.

In this theme, the JINR's network and information infrastructure is considered as a basic facility of the Institute. Structurally, the theme includes five sections, each corresponds to the mentioned above main directions.

In the first direction, organization of a high-speed channel JINR–Moscow and extension of the international data link are planned:

- at the first stage (2003–2004), the speed of exchange should be 155 Mbps;
- at the second stage (2005–2006), increase in the JINR–Moscow channel capacity up to 1 GBps with possibility of its further growth in the subsequent years, and step-by-step increase of the international channel capacity, according to the requirements of the JINR program for research.

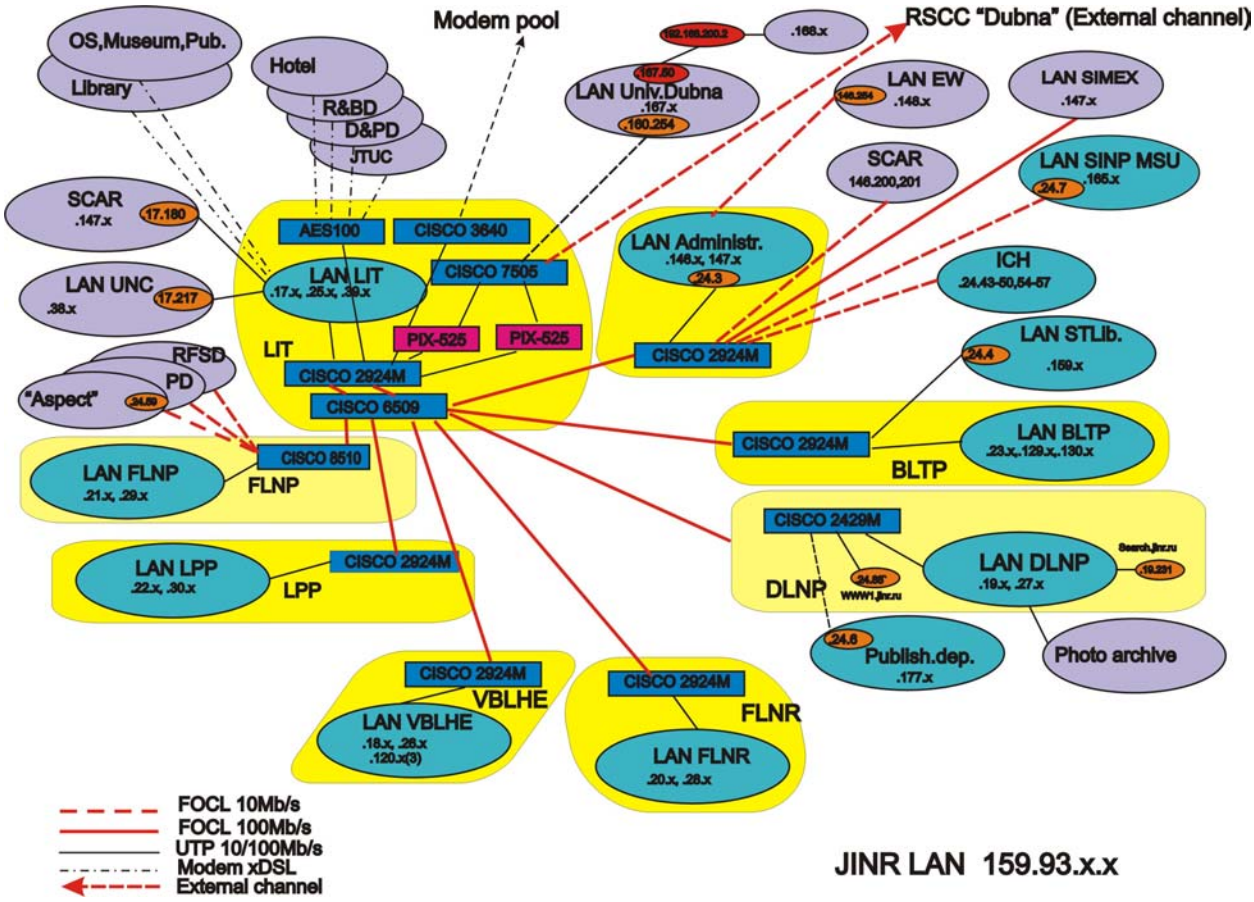
The second direction is aimed at:

- development of a reliable (fault-tolerant) architecture of the JINR LAN backbone with data transfer rate of 1 GBps;
- creation of the system for monitoring and handling the Institute's LAN;
- creation of the protection system of the JINR local area network;
- research in the information traffic of the Institute's LAN with the purpose of control and optimization of information flows.

In the third direction, the further development of the JINR Central Computing and Information Complex (JINR CCIC) will be provided with the basis of present-day technologies on creation of a distributed high performance computing infrastructure and resources of mass storage of specialized and common use.

In the fourth direction, creation of the unified information and computing environment of JINR and JINR Member Institutes will be provided by carrying out work on information, algorithmic and software support of the JINR's research-and-production activities.

The fifth direction is related to introduction in JINR of modern GRID technologies and creation of a GRID-segment at JINR. In the framework of international cooperation under the projects EGEE (Enabling Grids for E-science in Europe) and LCG (LHC-computing Grid) together with Russian scientific centres, creation of an infrastructure for work in frames of the worldwide Grid-structure.


Modem pool
RSCC "Dubna" (External channel)
OS,Museum,Pub.
Library
Hotel
R&BD
D&PD
JTUC
LAN Univ.Dubna
.167.x
.160.254
.168.x
LAN EW
.148.x
LAN SIMEX
.147.x
SCAR
146.200.201
LAN SINP MSU
.165.x
.24.7
SCAR
.147.x
.17.180
AES100
CISCO 3640
CISCO 7505
LAN LIT
.17.x, .25.x, .39.x
LAN Administr.
.146.x, 147.x
.24.3
ICH
.24.43-50,54-57
LAN UNC
.38.x
.17.217
PIX-525
PIX-525
LIT
CISCO 2924M
CISCO 6509
CISCO 2924M
LAN STLib.
.24.4
.159.x
RFSD
PD
"Aspect"
CISCO 2924M
LAN BLTP
.23.x,.129.x,.130.x
BLTP
CISCO 8510
LAN FLNP
.21.x, .29.x
FLNP
CISCO 2429M
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DLNP
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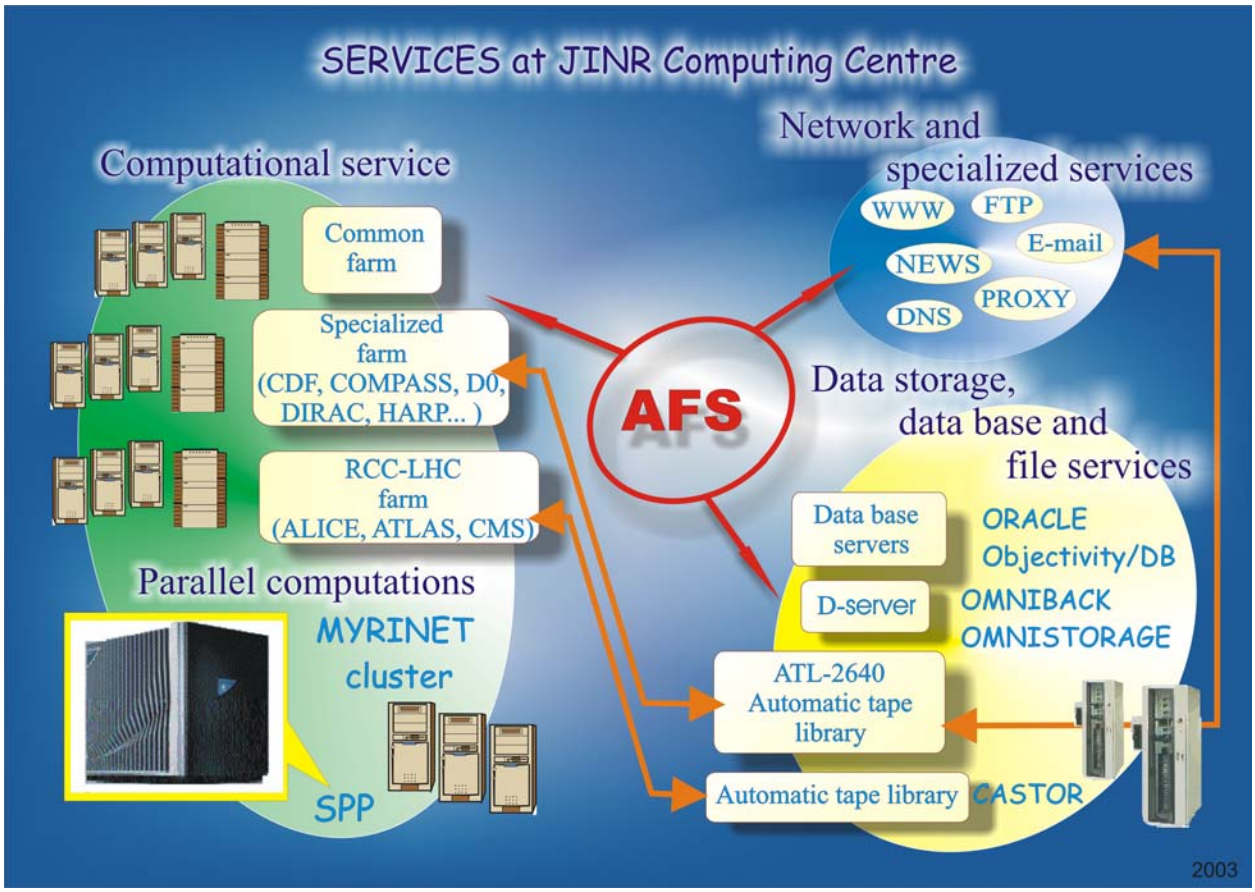
CISCO 2924M
LPP
.24.6
Publish.dep.
.177.x
Photo archive
CISCO 2924M
VBLHE
LAN VBLHE
.18.x, .26.x
.120.x(3)
CISCO 2924M
FLNR
LAN FLNR
.20.x, .28.x
FOCL 10Mb/s
FOCL 100Mb/s
UTP 10/100Mb/s
Modem xDSL
External channel
JINR LAN 159.93.x.x


SERVICES at JINR Computing Centre
Computational service
Common farm
Specialized farm (CDF, COMPASS, D0, DIRAC, HARP...)
RCC-LHC farm (ALICE, ATLAS, CMS)
Parallel computations
MYRINET cluster
SPP
AFS
Network and specialized services
WWW
FTP
E-mail
NEWS
PROXY
DNS
Data storage, data base and file services
Data base servers
ORACLE
Objectivity/DB
D-server
OMNIBACK
OMNISTORAGE
ATL-2640 Automatic tape library
Automatic tape library
CASTOR
2003

09-6-1041-2002/2004	Priority: 1
	Status: In-progress

Computer Physics for Theoretical and Experimental Research

Leader from JINR: I. Puzynin, A. Polanski

Participating countries and international organizations: Armenia, Austria, Belarus, Belgium, Brazil, Bulgaria, CERN, Czech Republic, Germany, Greece, Georgia, Hungary, Italy, Japan, JINR, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovak Republic, Switzerland, Sweden, South Africa, Taiwan, the USA, Ukraine, the United Kingdom, Uzbekistan.

The development of mathematical models of physical processes and methods of data analysis of observations (simulated and actual ones) under study is the integral part of investigations conducted in the field of experimental and theoretical physics and in other areas of science and technology. Results of such investigations in many respects depend upon adequacy of the developed mathematical model to the studied process and upon effectiveness of the applied methods of data analysis.

The main goal of the theme is a mathematical and algorithmic support of experimental and theoretical research under way at JINR. It includes the following basic directions:

- Development of new approaches and methods for modeling physical processes and experimental data analysis;
- Development of new methods and numerical algorithms for modeling magnetic systems and transporting charged particles beams;
- Design of program and computer complexes for data processing and their application to experiments conducted at JINR;
- Development of numerical schemes and programs for modeling complex physical systems;
- Development of methods, algorithms and software for computer algebra.

The subjects of this direction cover a wide spectrum of JINR's projects in the field of high-energy physics, nuclear physics, and condensed matter physics, biophysics, information technologies and is realized at close cooperation with all JINR laboratories, JINR Member State institutes and other centres of science.

In the framework of this theme, the development of methods and software packages is planned for modeling, processing and analysis of data for many experiments including STAR, CMS, ATLAS, ALICE, LHCb, COMPASS, HEND, SPHERE, FAZA, HERA-B, FOBOS, PoLiD, SAD, ENERGIA + TRANSMUTACJA, DIRAC, DUBTO, etc. The development of numerical algorithms and software will be realized for the problems of solid state physics. The development of methods and models of molecular dynamics and research in the quantum information theory will be in progress.

In order to solve these problems successfully, the application of new approaches to building-up mathematical models and methods for observation data analysis is planned: cellular automata, artificial neural networks, fuzzy logics, genetic algorithms, fractals, wavelets, nonlinear and SSA analysis of time series, etc. The new technologies essentially extend the possibilities of traditional approaches, in particular, such as Monte-Carlo method or statistical methods allowing the researcher to understand better the nature of the process under study and to increase the processing efficiency.

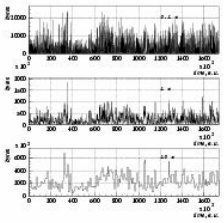


Figure 1: Traffic measurements aggregated with different bin sizes: 0.1 s, 1 s and 10 s

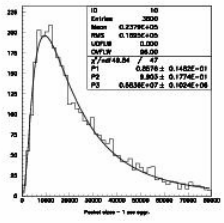


Figure 2: Packet size distribution for traffic measurements aggregated with 1 s window

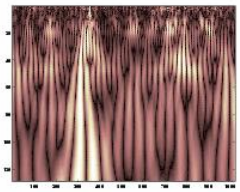
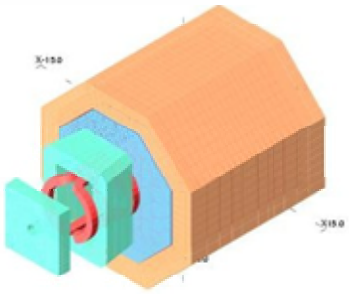
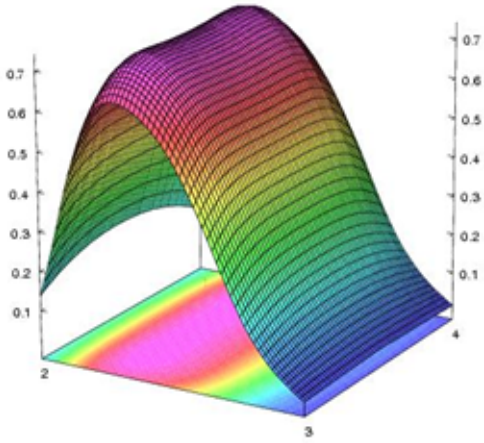


Figure 3: Shade plot of the CWT coefficients for traffic measurements aggregated with 1 s window





Component: BX
Minimum = 0.0124404, Maximum = 0.74174
Integral = 10.9823

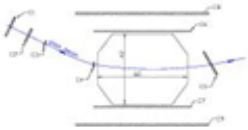


Figure 1: Outline of the experimental setup STREAMER: 47 × 60cm streamer chamber and hodoscope of scintillation counters $C1 \div C9$

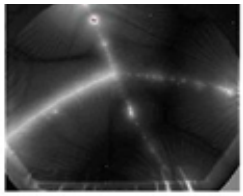


Figure 2: Vidio-image of the three-prong $\pi^{+4}He$ interaction in the streamer chamber

Data Analysis and Signal Processing
Magnetic System Simulation
Monte Carlo and Statistical Methods
Complex System Modeling and Analysis
Methods of Computational Physics
Computer Algebra

$$\pi^{+4}He \rightarrow \pi^{+}2p2n \quad (1)$$

$$\pi^{+4}He \rightarrow \pi^{+}p^{3}H \quad (2)$$

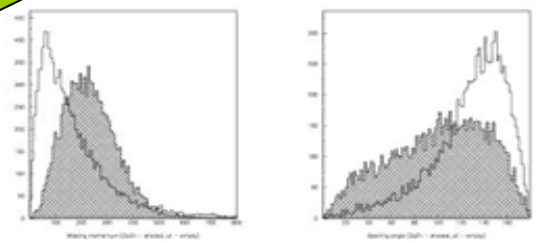
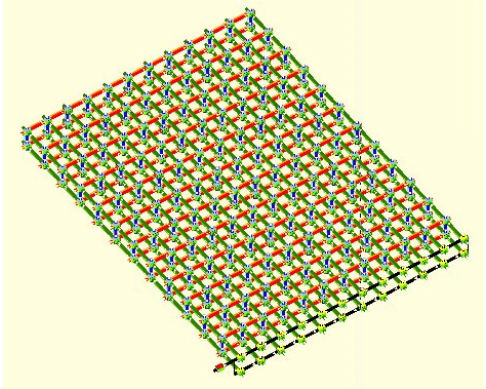
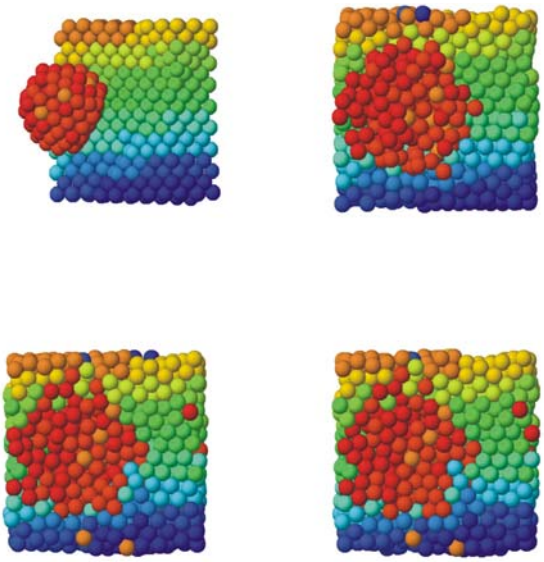


Figure 3: Distributions of the reaction missing momentum (left plot) and of the opening angle (right plot) between the strongly ionizing particles for reaction (1) (shaded histogram) and for reaction (2) (empty histogram)





09-8-1037-2001/2005	Priority of the project: 2
	Status: In-progress

Analitical and Methodological Work to Assess the Prospects of Scientific Research and Cooperation in the Main Directions of JINR's Development

Leader from JINR: V. Senchenko

Participating countries and international organizations: Belarus, Belgium, CERN, CLAF, Germany, Hungary, JINR, Russia, Ukraine, UNESCO.

Preparation by the JINR Scientific Organizing Department of analytical materials on the perspectives of scientific research. Assistance to the JINR Directorate in the preparation and implementation of the Institute's reform programme in the scientific domain; analysis of the results of reforms.

Methodological work contributing to the transition toward project-topical and special-purpose financing of research programmes, projects and facilities. Preparation of annual Topical Plans for JINR Research and International Cooperation. Application of data base systems for the analysis of results of theoretical and experimental research activities.