

ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ
JOINT INSTITUTE FOR NUCLEAR RESEARCH

Implementation of the recommendations of the Scientific Council's 91st and 92nd session

V.G. Kadyshevsky

93rd session of the JINR Scientific Council
16 January 2003

Contents

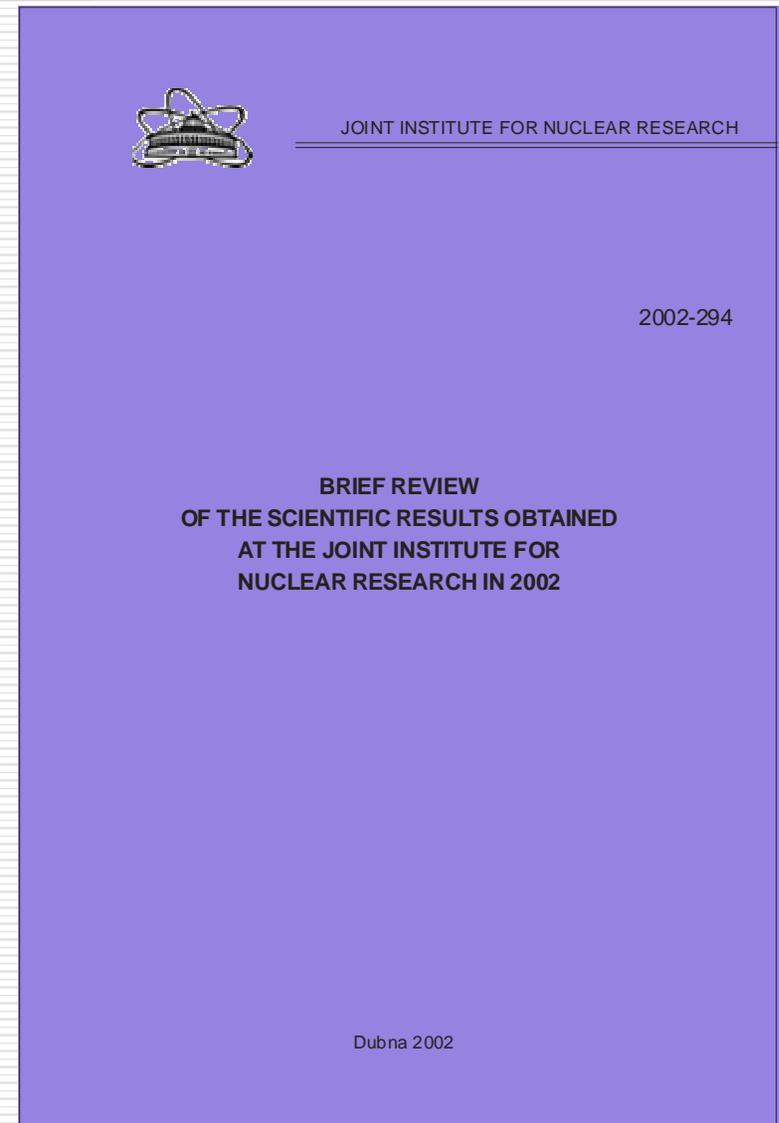
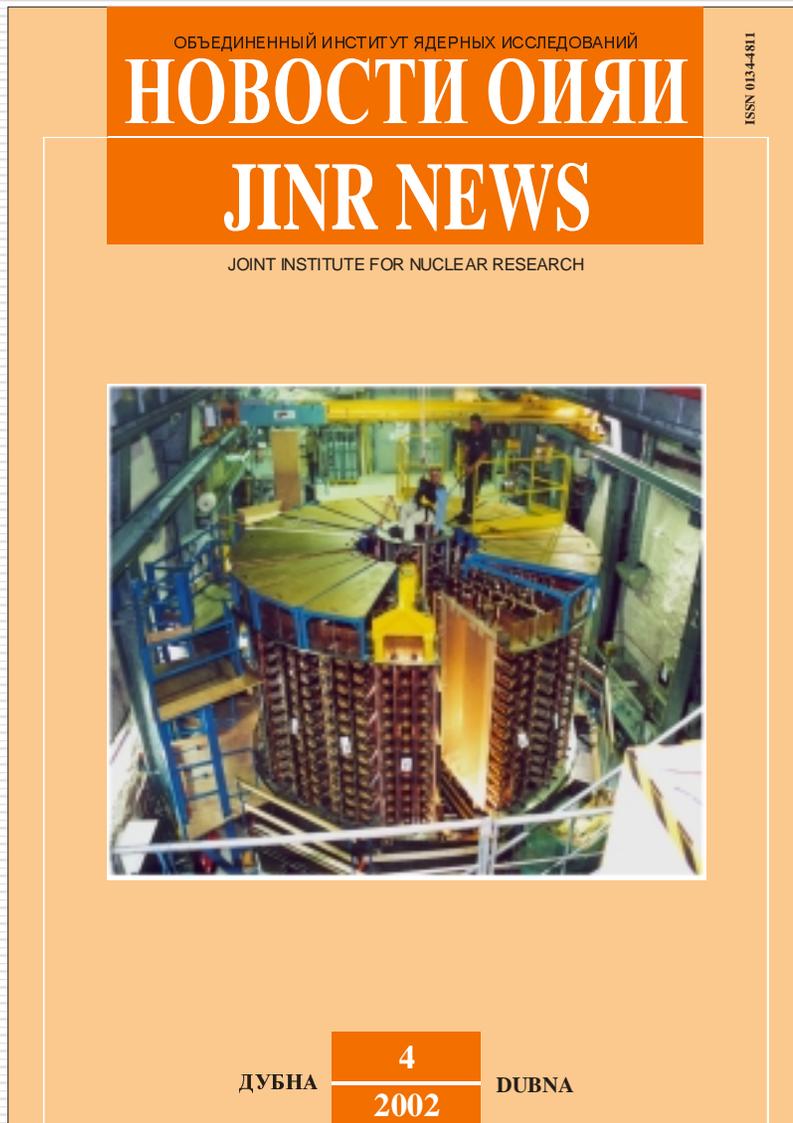
□ Highlights of 2002

- Operation of the JINR facilities
- Scientific Results
- Funding of Research

□ JINR's Scientific Programme in 2003

□ Latest news in brief

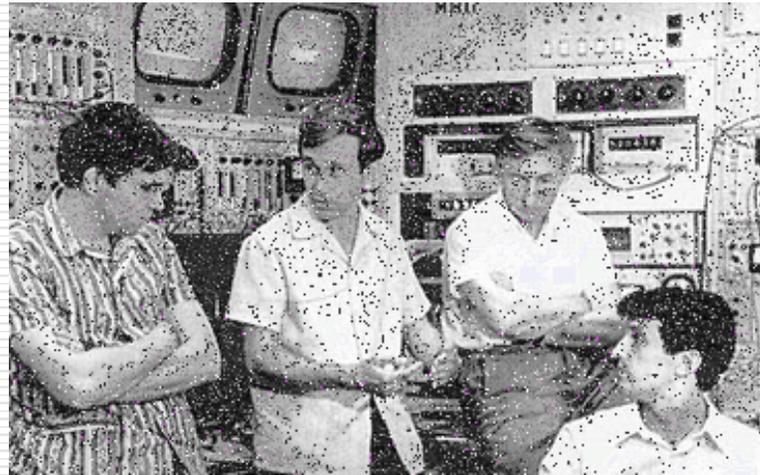
Documents



State Prize of the Russian Federation



I. Meshkov, JINR



**V.V. Parkhomchuk, A.N. Skrinsky,
I.N. Meshkov, N.S. Dikansky,
NAP-M, 1975**

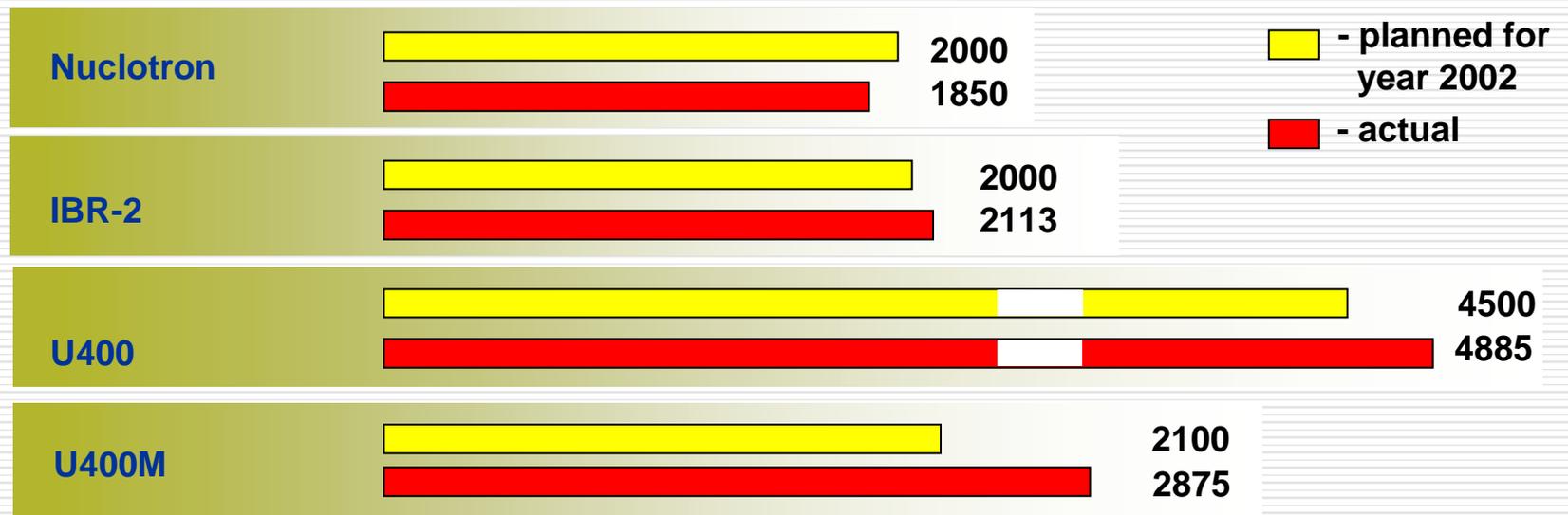


A.M. Budker, 1961

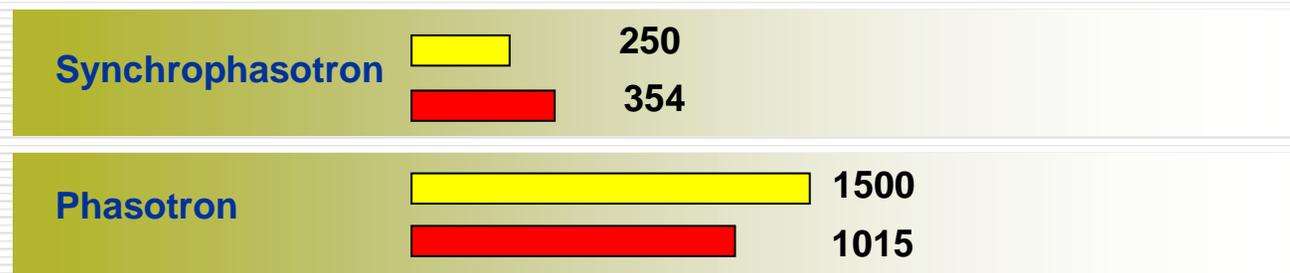
On 5 August 2002 the Russian President V. Putin signed the order for awarding with State Prize of RF where the “Method of electron cooling of heavy charged particle beams” is marked.

Operation of JINR facilities in 2002

Basic Facilities

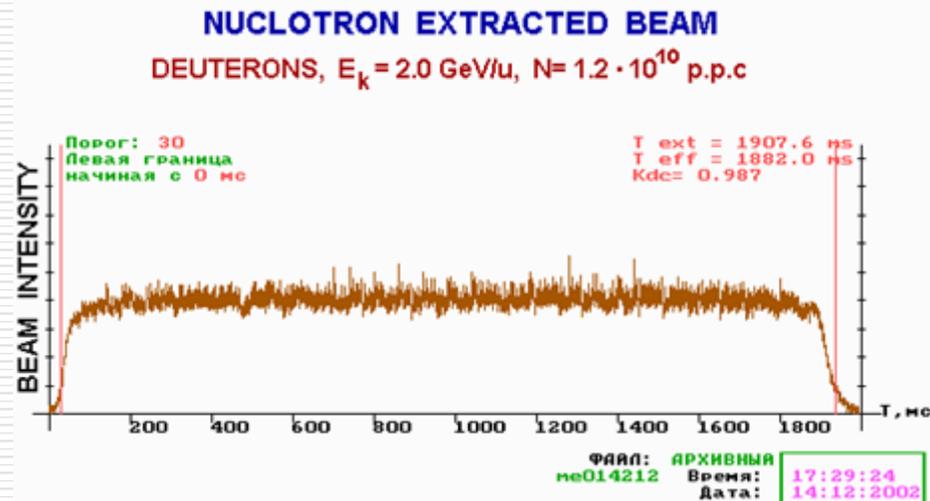


Facilities operating by users' request



Nuclotron

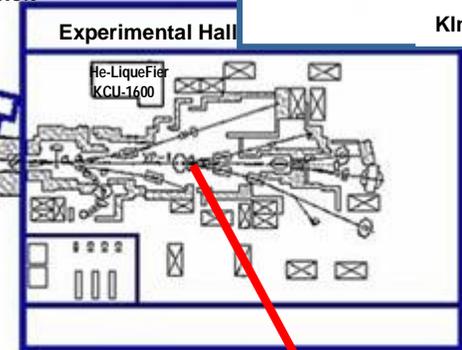
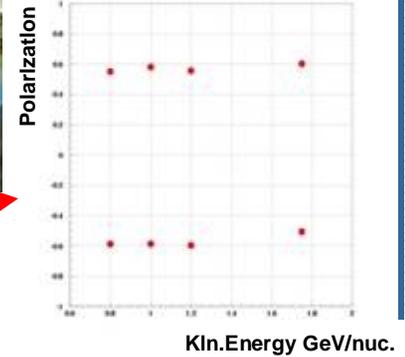
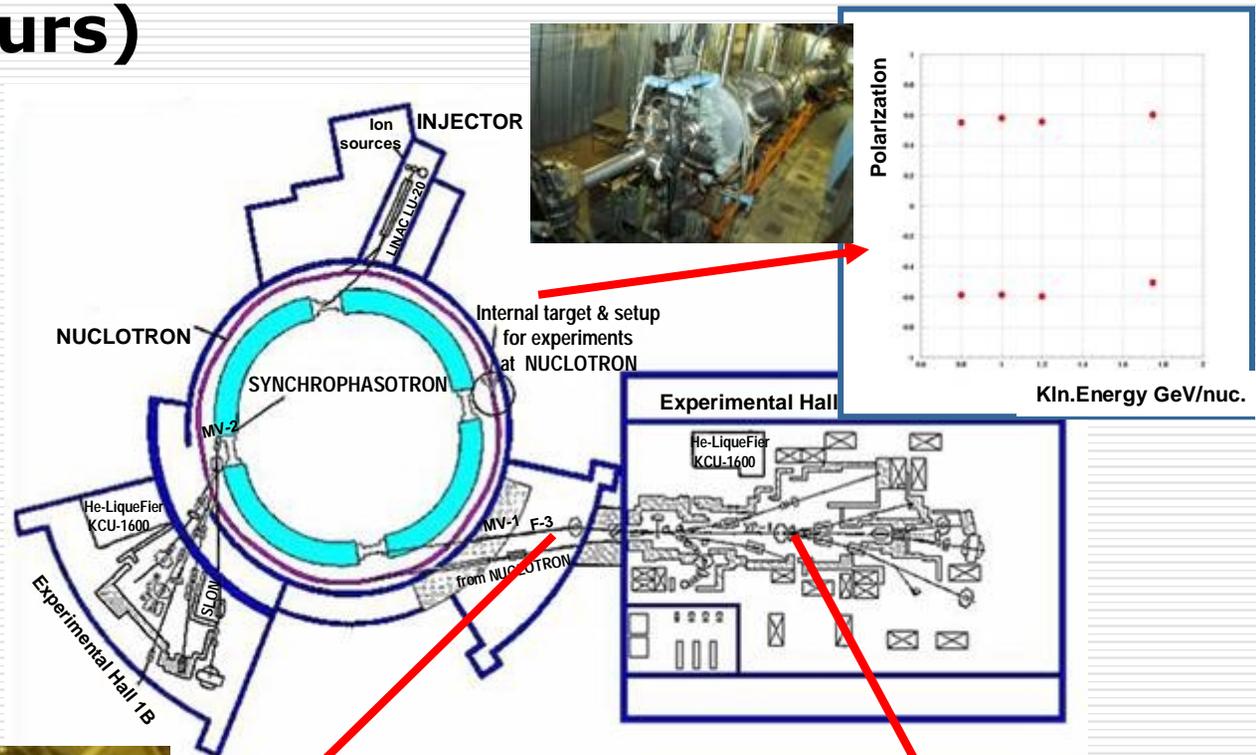
- Run 22 (632 hours)
 - Intensity of the external beam of magnesium ions was increased up to $\approx 10^8$
- Run 23 (704 hours)
 - Ions of argon were accelerated for the first time with the intensity of $1.4 \cdot 10^6$ and $E_k \approx 1$ GeV/n.
 - Duration of extracted beam was increased up to 1.9 s.



Polarized Deuteron Beam at Nuclotron

Run 24 (514 hours)

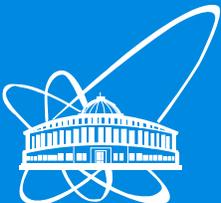
- **EXTERNAL BEAM ENERGY:**
up to 2.2 GeV/u
- **INTENSITY:**
 $1.5 \cdot 10^8$ d⁺/cycle
- **POLARIZATION:**
 ≈ 0.6
(the same as for injected beam)



Polarimeter F3
 $P_z(+)=0.59 \pm 0.06$
 $P_z(-)=-0.63 \pm 0.06$

Polarimeter "ALPOM"

The experiments on the synthesis of element 118



СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ
Дубна

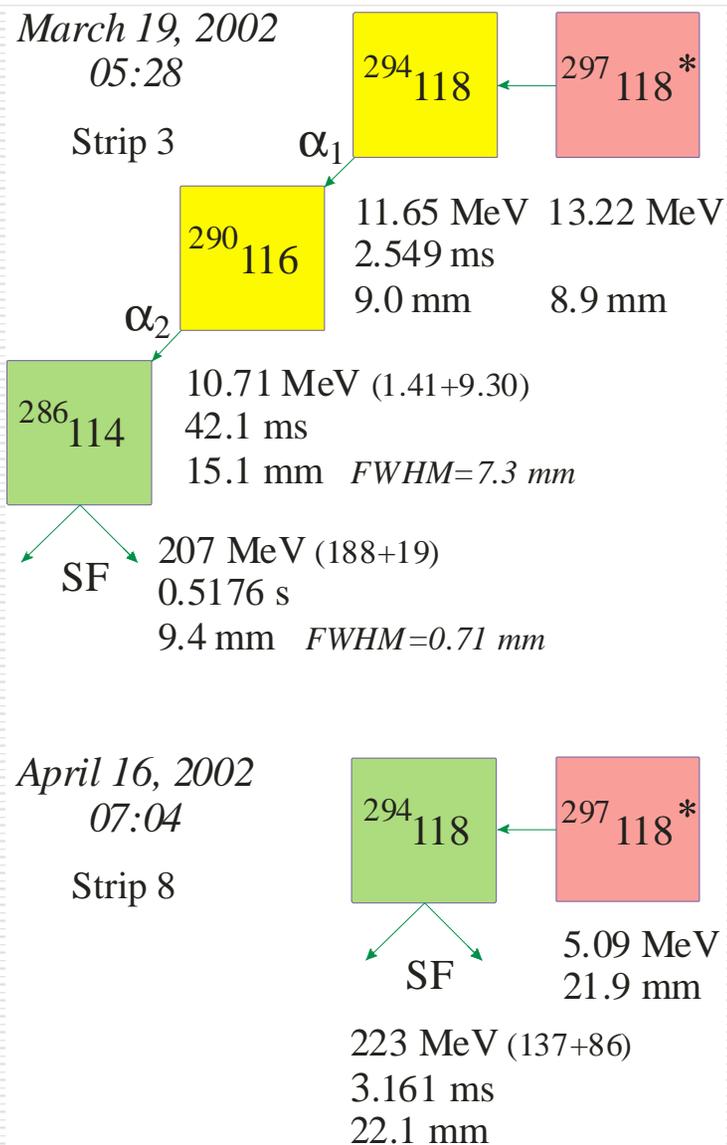
D7-2002-287

Yu. Ts. Oganessian, V. K. Utyonkov, Yu. V. Lobanov,
F. Sh. Abdullin, A. N. Polyakov, I. V. Shirokovsky, Yu. S. Tsyganov,
A. N. Mezentsev, S. Iliev, V. G. Subbotin, A. M. Sukhov,
O. V. Ivanov, A. A. Voinov, K. Subotic, V. I. Zagrebaev, M. G. Itkis,
K. J. Moody*, J. F. Wild*, M. A. Stoyer*, N. J. Stoyer*,
C. A. Laue*, D. A. Shaughnessy*, J. B. Patin*, R. W. Lougheed*

RESULTS FROM THE FIRST $^{249}\text{Cf} + ^{48}\text{Ca}$ EXPERIMENT

*University of California, Lawrence Livermore National Laboratory, Livermore,
California 94551, USA

2002



DRIBs

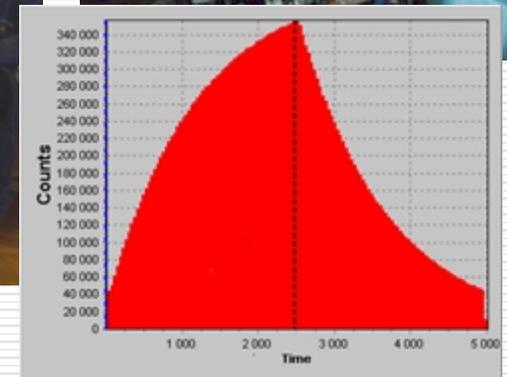


Yu. Oganessian
Project Scientific
Leader



G. Gulbekyan
(Project Technical Leader, in center)
with his colleagues

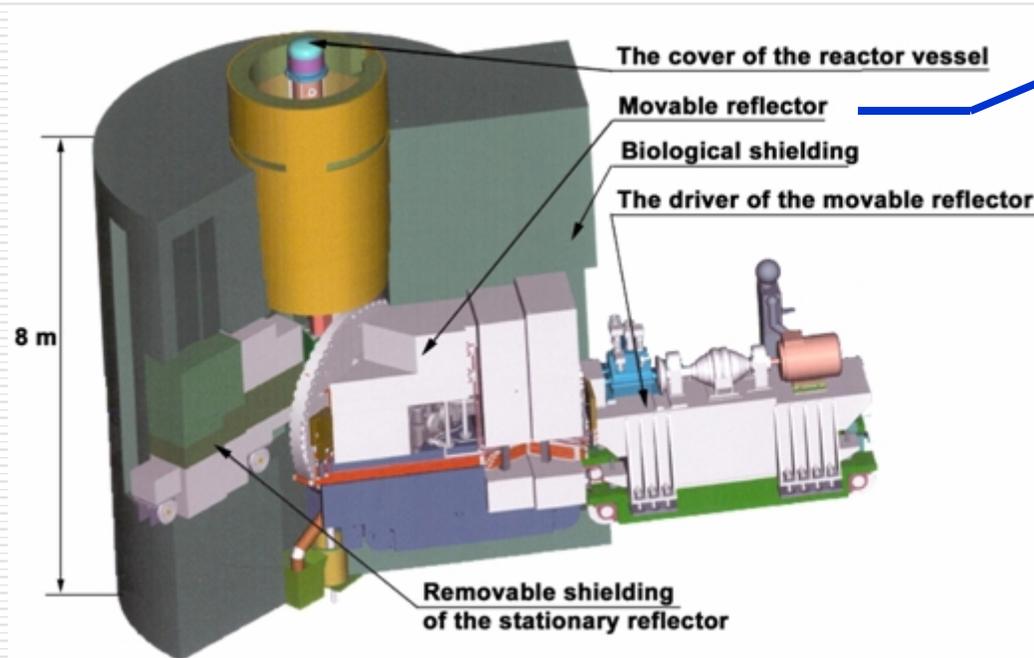
**New injection
system at U400**



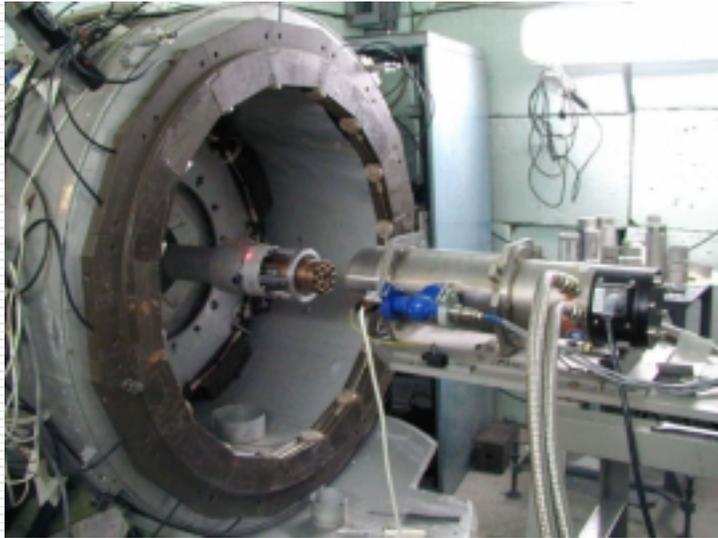
**Diagram of accumulation
and β -decay of ${}^6\text{He}$ after
acceleration in U400
(half time of decay is 0.8 s)**

IBR-2

- ❑ The production and testing assembly of subsystem for the movable reflector was completed in the JINR Central Workshop.
- ❑ The financial support of Minatom (13.5 million roubles) for the IBR-2 reactor modernization was contributed timely and in full volume.

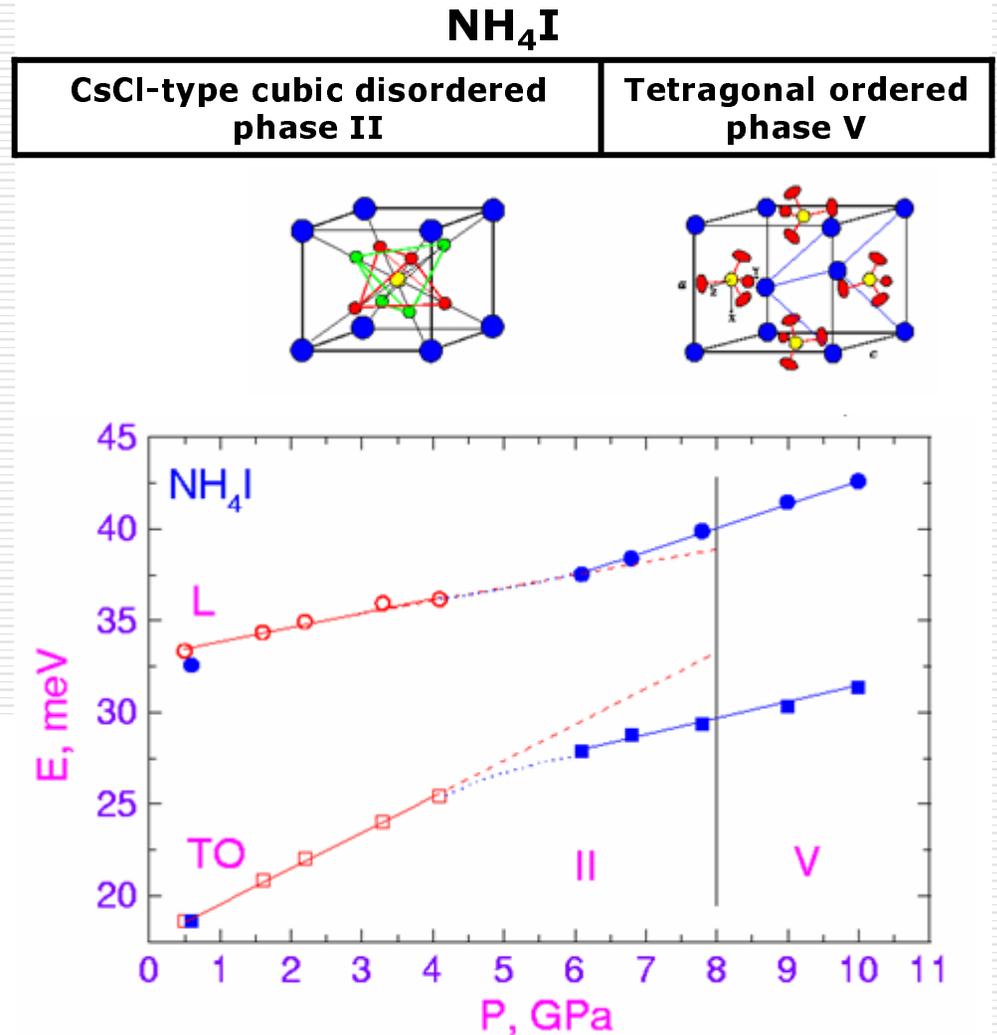


Neutron Investigations at High Pressure



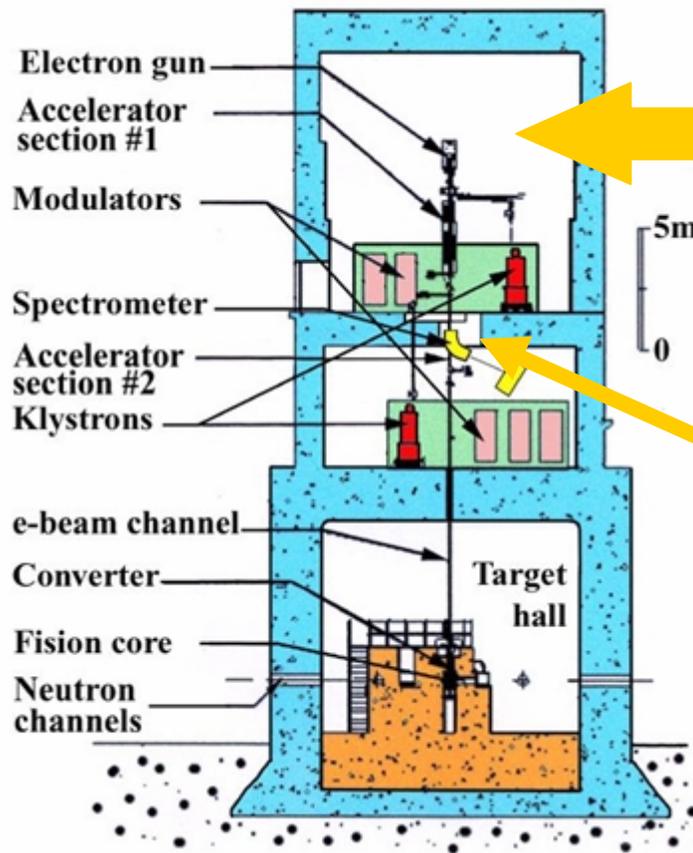
DN-12 spectrometer at IBR-2

Librational (L) and transverse optical (TO) modes frequencies in NH_4I as functions of pressure. Red open symbols – data obtained with sapphire anvil high pressure cell. Blue solid symbols – data obtained using high pressure cell of “Toroid” type with tungsten carbide anvils.



IREN

- ❑ The dismantling of the old linear electron accelerator LUE-40 is completed in 2002.
- ❑ The installation of a new linac is started.



Installation of the supporting element for a new linac

Quantum states of neutrons in the Earth's gravitational field

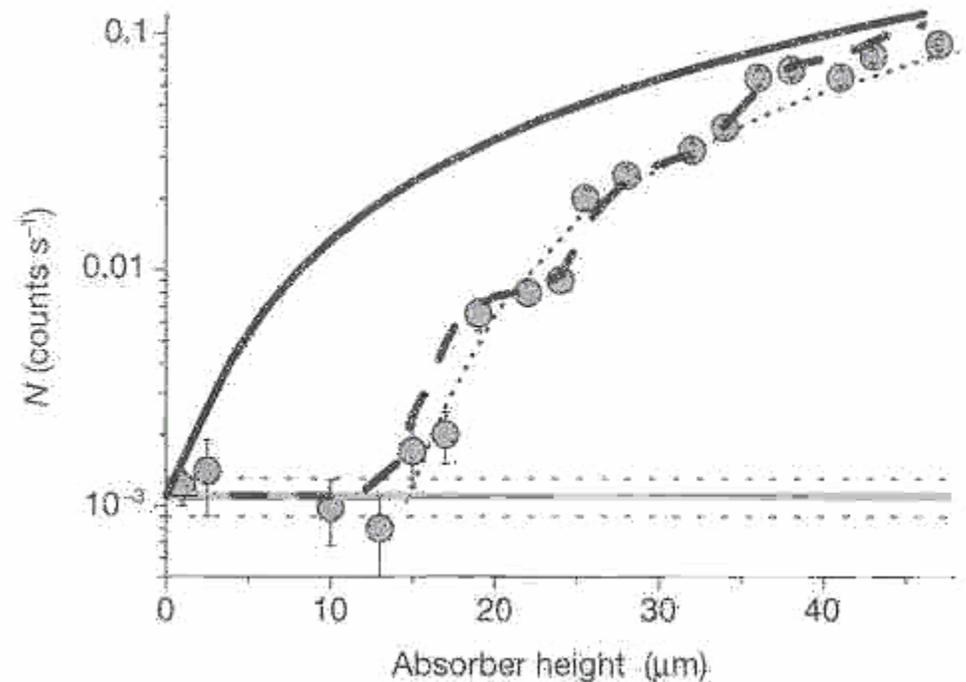
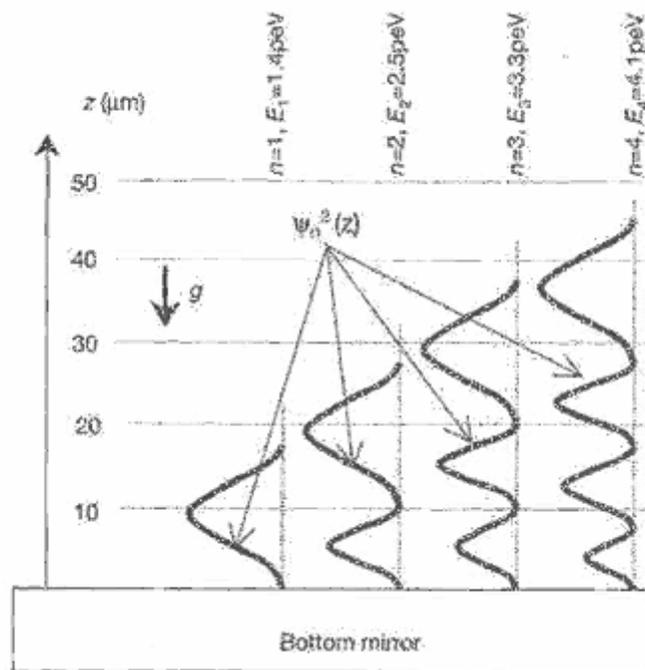
Proposal: V.I.Luschikov, *Proceedings of the International Conference on the Interaction of Neutrons with Nuclei*, July 6-9, 1976, Lowell, USA

V.I.Luschikov, *Ultracold neutrons*, *Physics Today*, June 1977, p.42-51.

V.I.Luschikov, A.I.Frank, *Quantum effects occurring when ultracold neutrons are stored on a plane*, *JETP Letters* 28, p.559-561 (1978).

Measurement: *Nature* 415, p.297-299 (17 January 2002)

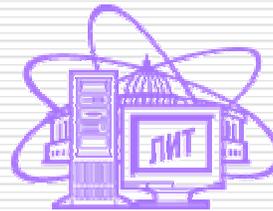
V.V.Nesvizhevsky*, H.G.Börner*, A.K.Petoukhov* ‡, H.Abele†, S.Baeßler†, F.J.Rueß†, T.Stöferle†, A.Westphal†, A.M.Gagarski‡, G.A.Petrov‡ & A.V.Strelkov§, * *ILL, Grenoble, France*; † *University of Heidelberg, Germany*; ‡ *PNPI, Gatchina, Russia* § *JINR, Dubna, Russia*.



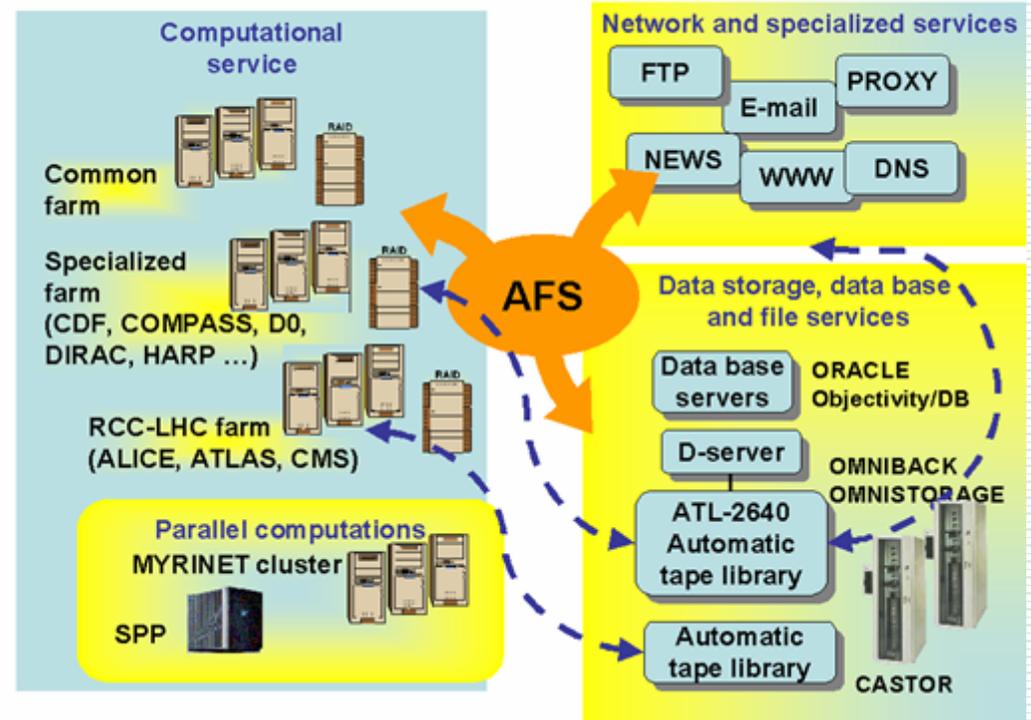
GRID Technologies

A multifunctional distributed computing system is created, which consists of an interactive cluster and three farms, used to solve various tasks, such as parallel computations, LHC Data Challenges, etc.

The cluster is a component of the Russian GRID segment and is used by CMS, ATLAS and ALICE collaborations for physics simulations and detector modelling.



SERVICES at LIT Computing Centre



Statistical Model of Network Traffic

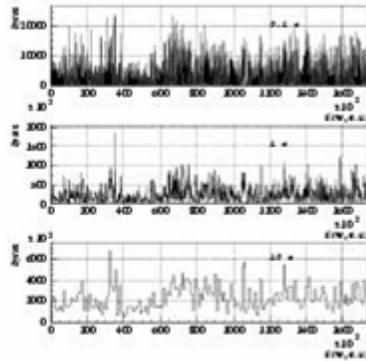


Figure 1: Traffic measurements aggregated with different bin sizes: 0.1 s, 1 s and 10 s

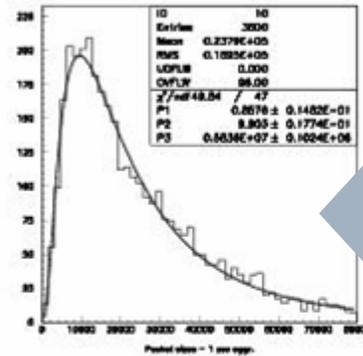


Figure 2: Packet size distribution for traffic measurements aggregated with 1 s window

The aggregation of traffic measurements (Fig. 1) leads to a statistical distribution that is approximated with a high accuracy by the log-normal function (Fig. 2).

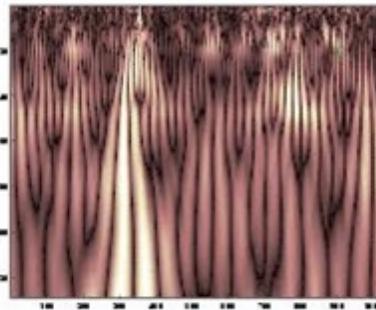
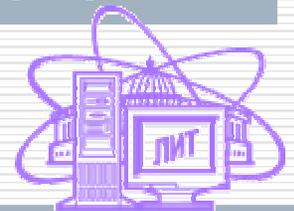


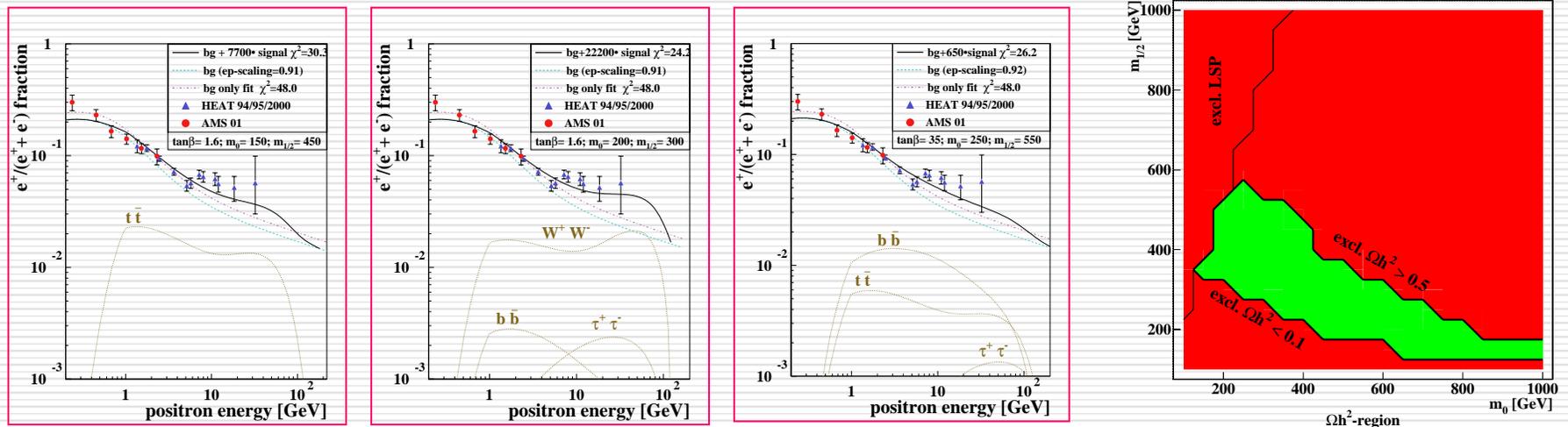
Figure 3: Shade plot of the CWT coefficients for traffic measurements aggregated with 1 s window

The log-normal distribution of traffic measurements and their multiplicative character (Fig. 3) indicate on applicability of Kolmogorov's scheme, developed for fragmentation of grains, also to the network traffic.

The statistical model of network traffic serves as a basis for development of efficient methods and tools for traffic control and computer networks protection.

Positron fraction from Dark Matter Annihilation in the CMSSM

Comparison of the cosmic rays positron fraction with the annihilation of neutralinos in the Constrained Minimal Supersymmetric Standard Model



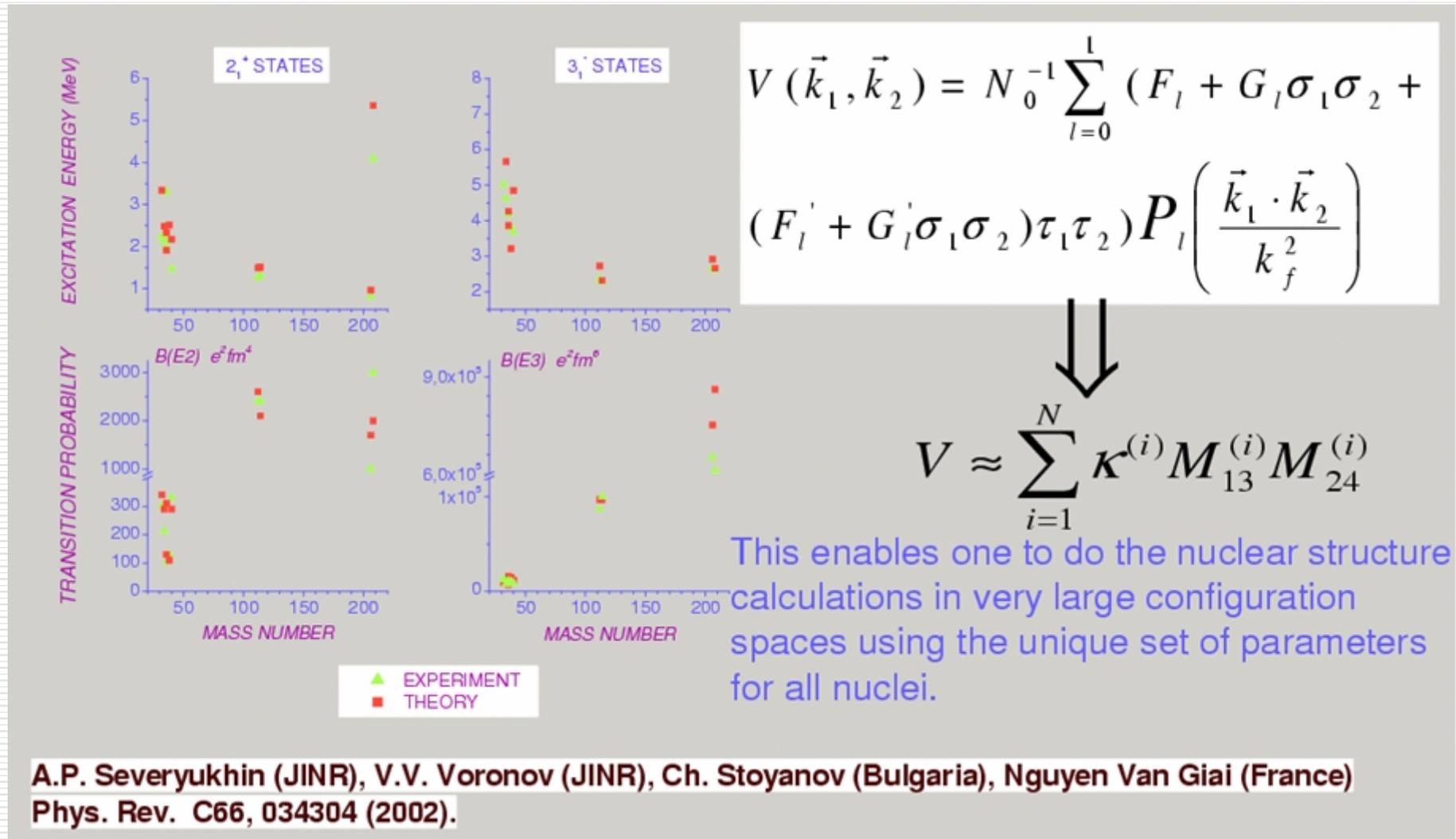
Dominant annihilation channels compared to data:

1. small $\tan\beta$, $m_\chi=180$ GeV, dominant channel $\chi^0\chi^0 \rightarrow t\bar{t}$
2. small $\tan\beta$, $m_\chi=130$ GeV, dominant channel $\chi^0\chi^0 \rightarrow W^+W^-$
3. large $\tan\beta$, dominant channel $\chi^0\chi^0 \rightarrow b\bar{b}$

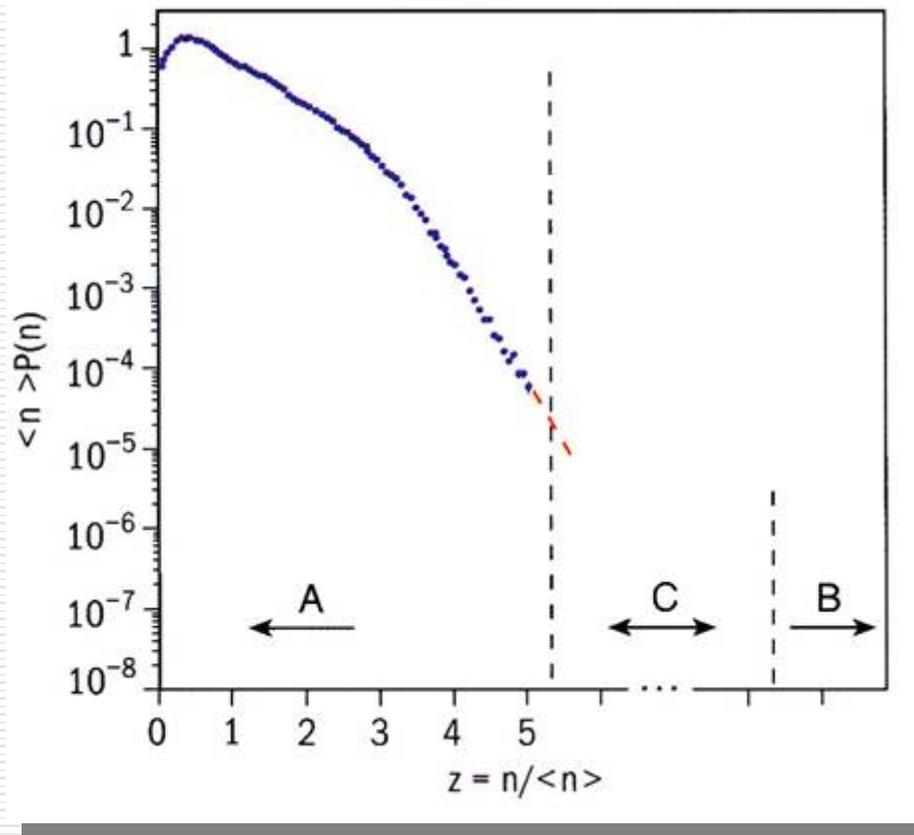
The preferred region of relic density between 0.1 and 0.5 for $\tan\beta=35$ as calculated with the DarkSUSY programme

W. de Boer, C. Sander, M. Horn, D. Kazakov, **Nucl. Phys. Proc. Suppl. 113 (2002) 221-228**

Nuclear Structure Calculations with Finite Rank Approximation for Skyrme Interactions



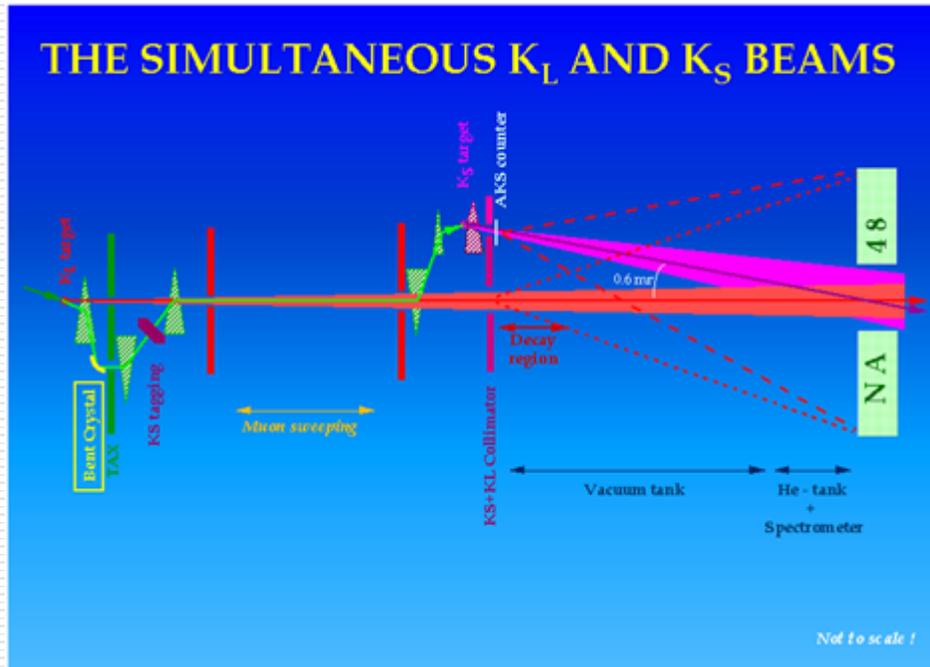
Thermalization Effect in Hadron Physics



Particle production:
the lower multiplicity region (A) is the result of processes with well known multiperipheral kinematics. The next region (B) includes processes near the kinematical limit, where the momenta of produced particles are smaller than their mass. The VHM events (C) are extremely rare, making up only about 10^{-7} of the total cross-section at the LHC energy. (The horizontal axis is the ratio of observed multiplicity to the mean value. The vertical axis is proportional to the ratio of the specific reaction rate-cross-section to the total cross-section.)

- I.D. Manjavidze, A.N. Sissakian. TMF. 2002.
- A.N. Sissakian. Report at the scientific session (27.11.2002) of Division of Physical Sciences of the Russian Academy of Sciences (to be published in UFN).

NA48

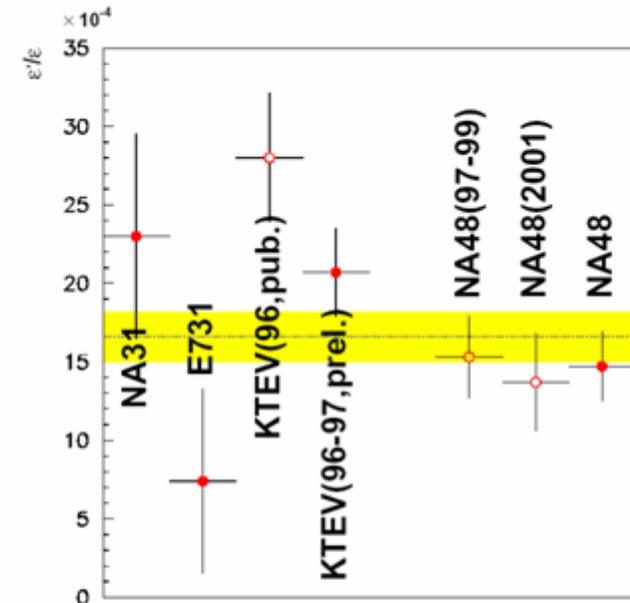


The most precise result on the measurement of the direct CP-violation effect has been obtained from the analysis of data on the decays of neutral kaons into two pions:

$$\text{Re}(\epsilon'/\epsilon) = (14,7 \pm 2,2) \times 10^{-4}$$

This result indicates that CP-violation effects are dominating in the $K_L^0 \rightarrow \pi^0 \gamma\gamma$ decay.

Experimental result comparison



World average: $\text{Re}(\epsilon'/\epsilon) = (16.6 \pm 1.6) \times 10^{-4}$
with $\chi^2/\text{ndf} = 6.2/3$

JINR's participation in ATLAS project



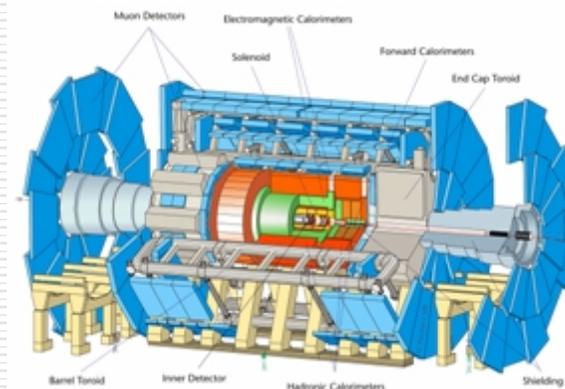
1st Module, Dubna, August 1999



33rd Module, Dubna, 12 January 2001



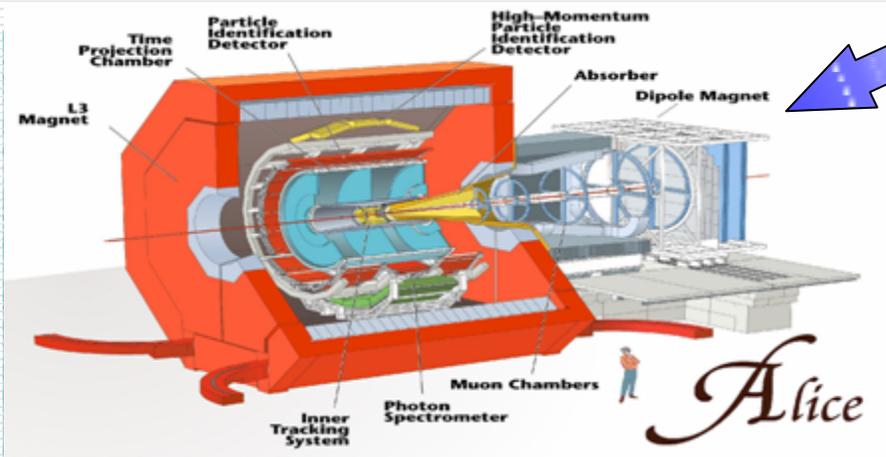
65th Module at CERN, 4 July 2002



Production and assembly of the Barrel part of the Tile Calorimeter have been completed!

JINR's participation in ALICE project

The iron yoke of the ALICE dipole magnet:
28 modules, 840 tons,
3 m in length, 7 m in width and 9 m in height



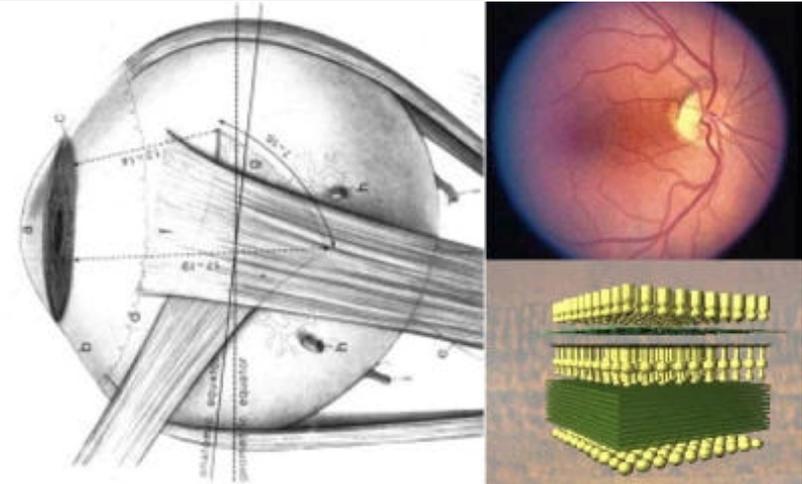
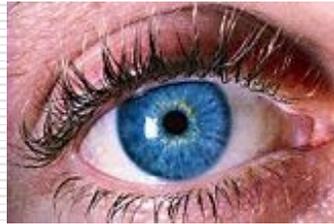
Dubna • Savelovo



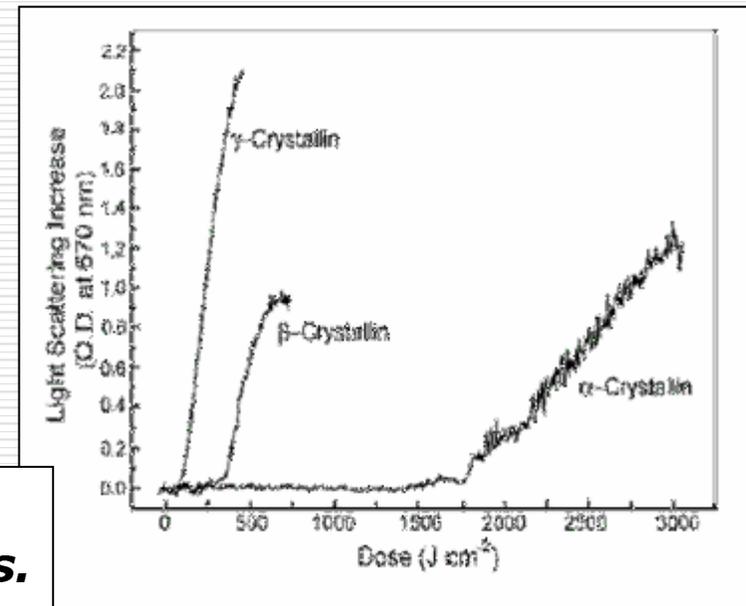
Biophysics of photo-biological processes

The main tasks:

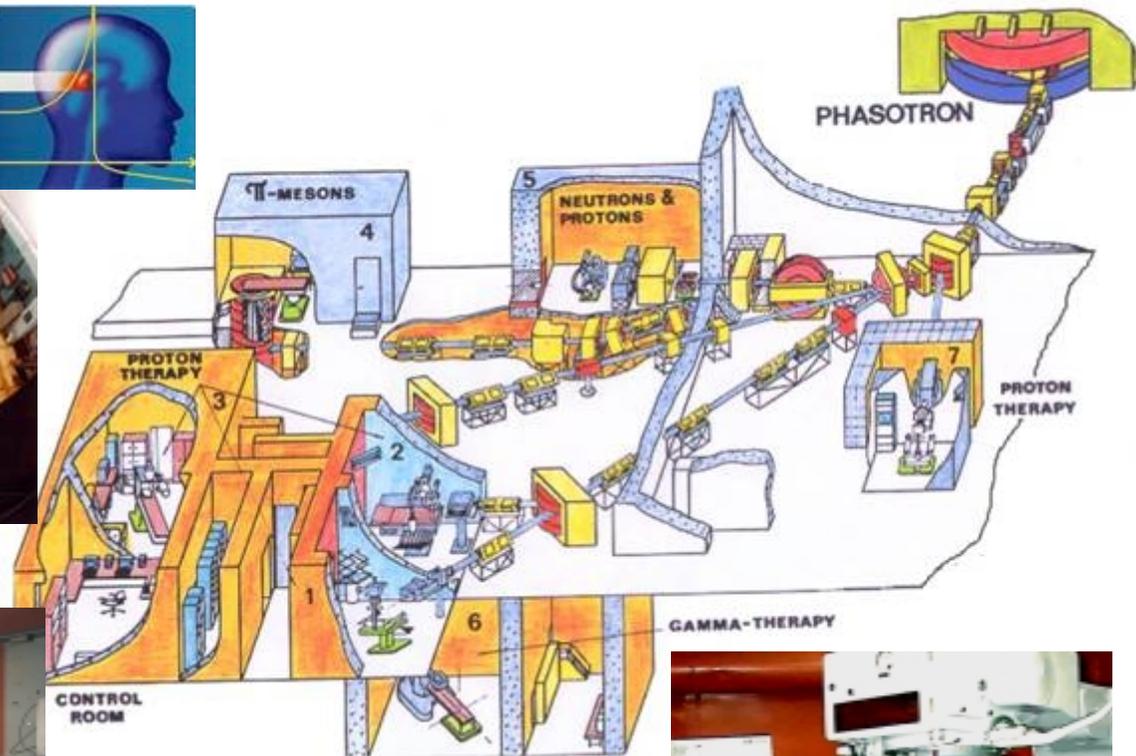
- molecular mechanisms of photo-reception;
- mechanism of cataract genesis induced by heavy charged particles;
- effects of heavy ion irradiation on retina and rhodopsin.



***Cataract genesis
Photo-kinetic curves of crystallins.***



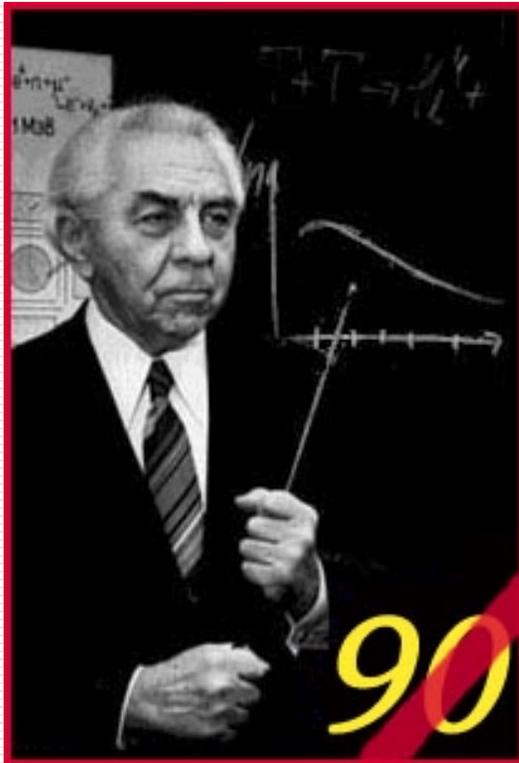
Hadron Therapy at Phasotron



**43 patients
(1057 proton treatment procedures)**



**69 patients
(2840 γ -ray treatment procedures)**



Dubna, 11th April 2003

V.P. Dzheleпов
90th birthday.

One Day Scientific Conference

Conference-hall
Dzheleпов Laboratory
of Nuclear Problems

<http://dzheleпов.jinr.ru>



- Meeting dedicated to the 90th anniversary of the birth of G.N.Flerov (1913-1990)
3 March, Dubna



- XII International Conference "Selected Problems of Modern Physics".
Dedicated to the 95th anniversary of the birth of D.I.Blokhintsev (1908-1979)
8-11 June, Dubna



- 2nd International summer students school on High Energy Physics
in Memory of B.M.Pontecorvo (1913-1993)
7-18 September, Alushta, Ukraine

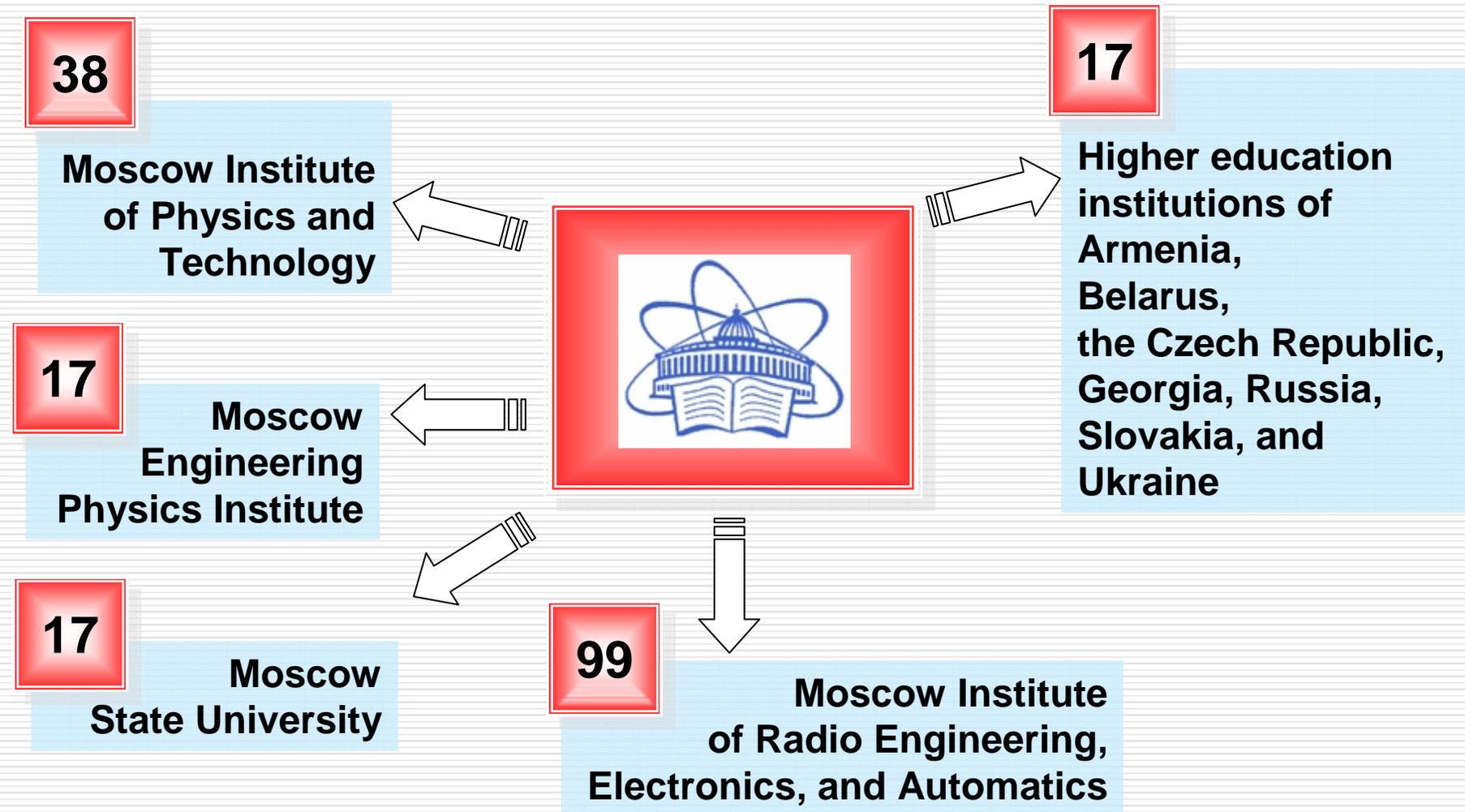
Council on Science and High Technology chaired by the President V.V. Putin

- Topics of the discussions:
 - problems of financing of academic and applied science research,
 - situation in Russian science-cities.



14 January 2003

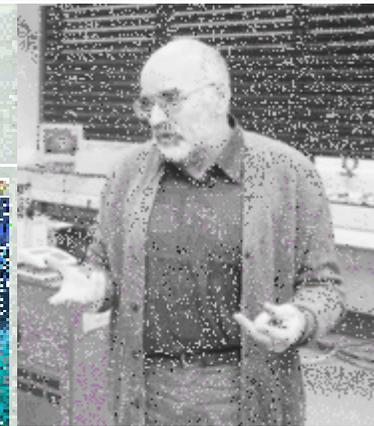
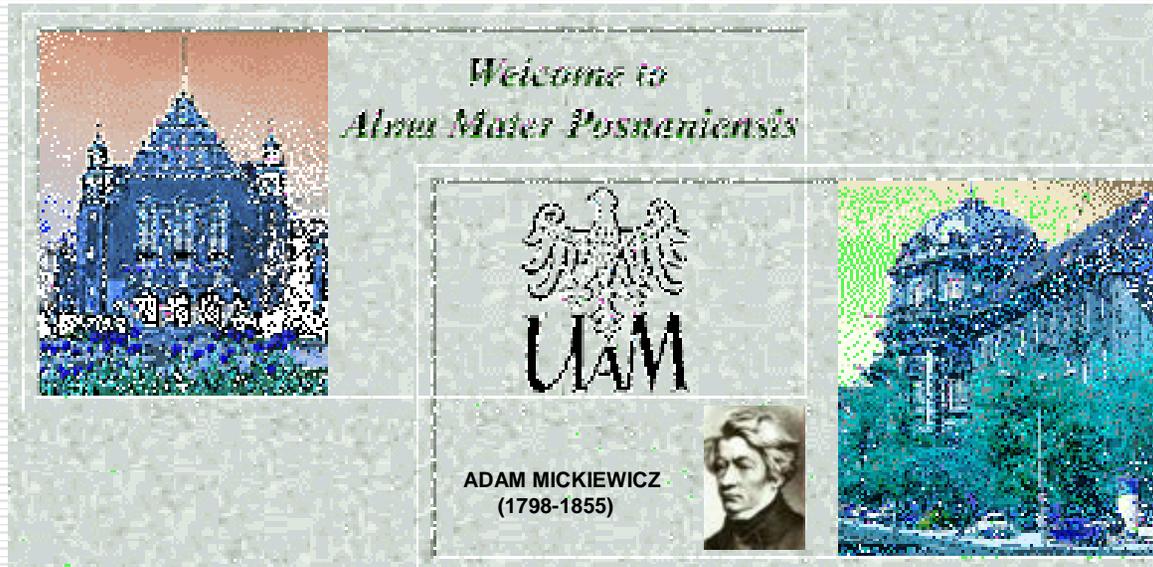
Students at the University Centre



Adam Mickiewicz University



Prof. W. Nawrocik



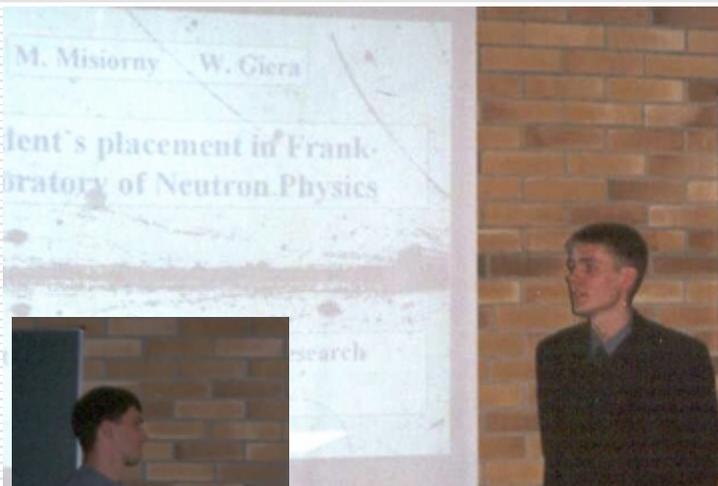
Prof. A. Dobek,
Dean of the Faculty
of Physics



**Posnan, Poland.
8 October 2002**



"JINR Today and Tomorrow" AMU, Poznan, 8 October 2002



Petr Benes (Prague)

Spectrometer TGV - data acquisition and data processing software.

Pavel Cermak (Prague)

Distinguishing of electrons and gamma rays in experiment TGV.

Alexander Andreev (JINR)

Polarization effects in dinuclear system and description of TKE of fission fragments.

Peter Kolonuto (JINR)

Status of hadron radiotherapy centre in Dubna

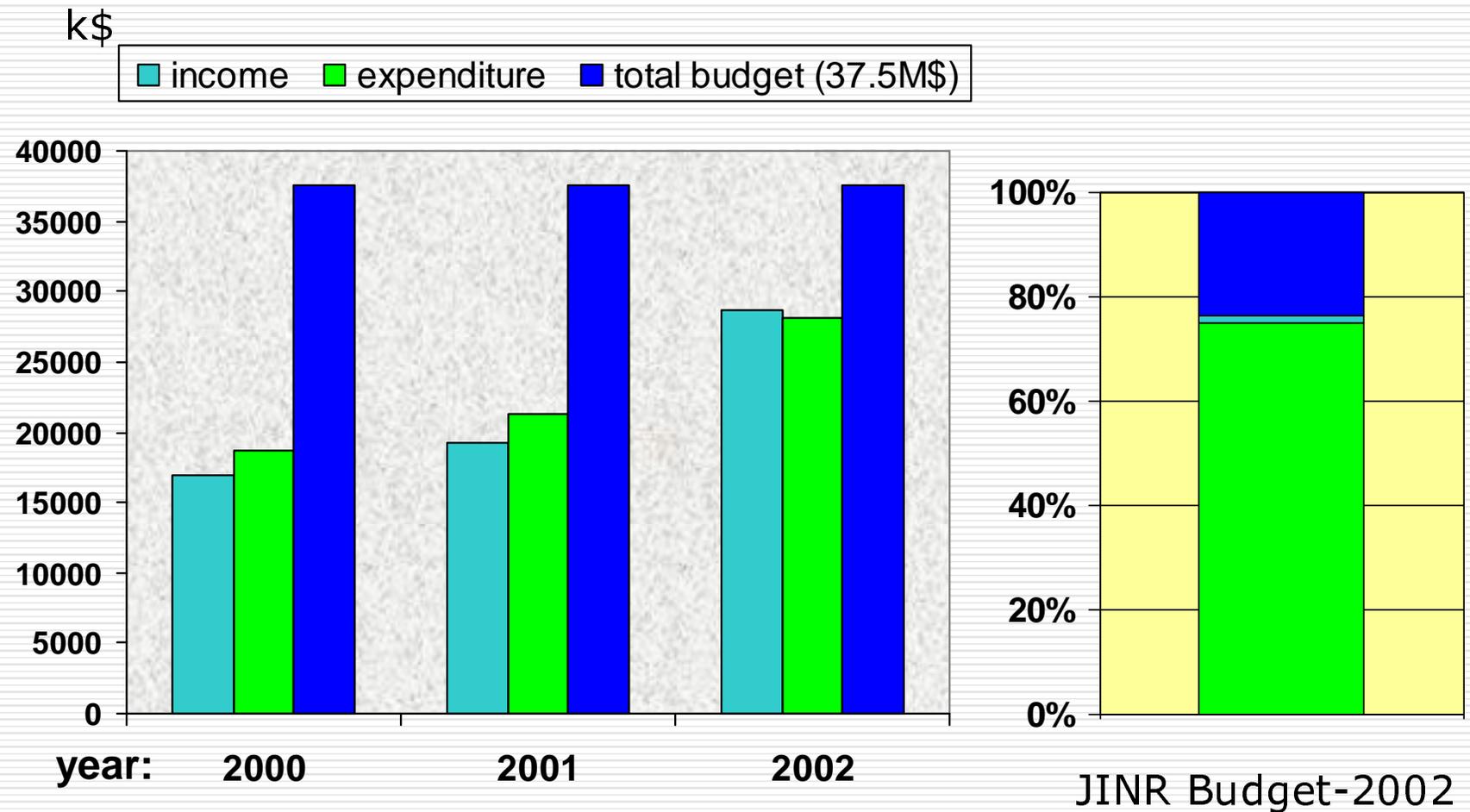
Zhanna Mezentseva (JINR)

The Investigation of the Resonance Structure of Fissionable and Constructional Nuclei using the Multiplicity Spectrometry.

Wojciech Giera (Poznan)

Investigation of the structure of lipid membrane with the help of X-ray diffractometer DRON-4

Incomes and expenditures



Meetings in Moldova



V.G. Kadyshevsky (JINR) and V. Iovv (Deputy Prime Minister), A.M. Andries (President of the Academy of Sciences), A. Rotaru (President of the Supreme Council for Science and Technological Development).
Moldova, Kishinev, 12 September 2002

V.G. Kadyshevsky (JINR) and A.M. Andries (President of the Academy of Sciences of Moldova)

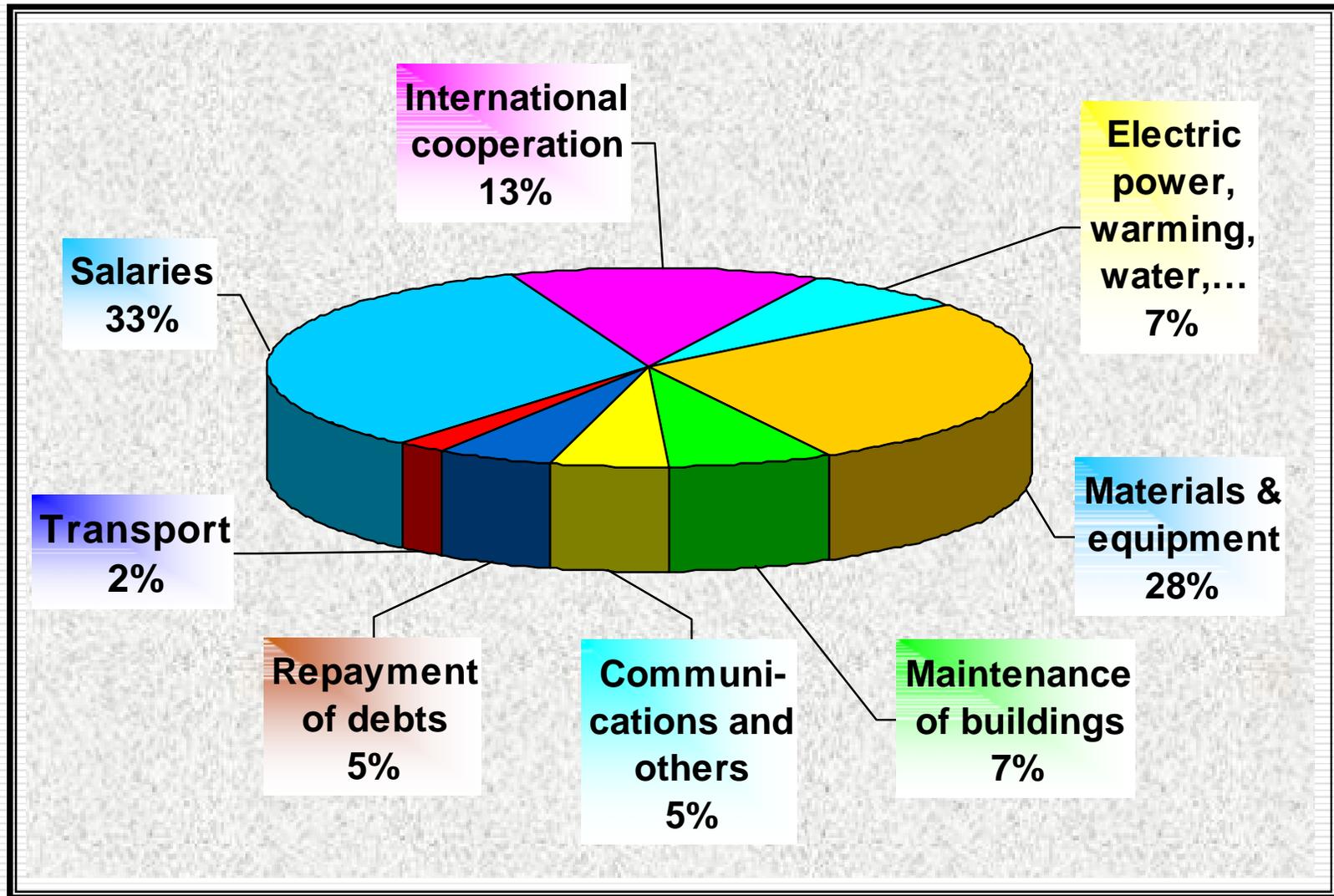
Financial Policy

- Meetings in Dubna:
 - Negotiation with the Polish delegation headed by Academician A. Hryniewicz, the Polish Plenipotentiary
 - The Committee of Plenipotentiaries' Working group on contributions and debts.
27 November 2002

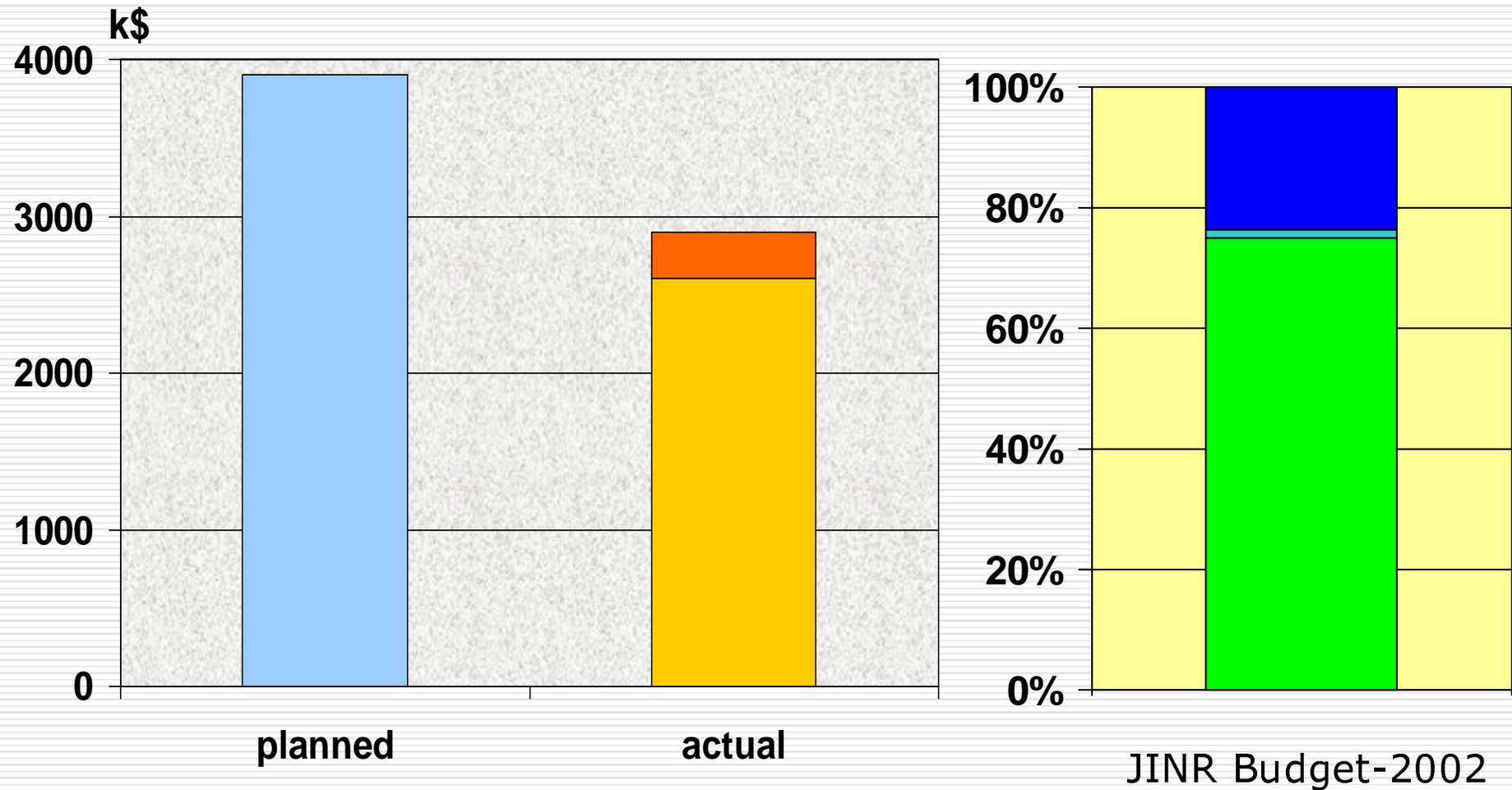


Polish Delegation at JINR

Structure of expenditures in 2002



Funding of the priority activities



Scientific Programme in 2003



ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

11-8136

**ПРОБЛЕМНО-ТЕМАТИЧЕСКИЙ ПЛАН
НАУЧНО-ИССЛЕДОВАТЕЛЬСКИХ РАБОТ
И МЕЖДУНАРОДНОГО СОТРУДНИЧЕСТВА
ОБЪЕДИНЕННОГО ИНСТИТУТА
ЯДЕРНЫХ ИССЛЕДОВАНИЙ
НА 2003 ГОД**

Дубна 2002



JOINT INSTITUTE FOR NUCLEAR RESEARCH

11-8135

**TOPICAL PLAN
FOR JINR RESEARCH
AND INTERNATIONAL COOPERATION
IN 2003**

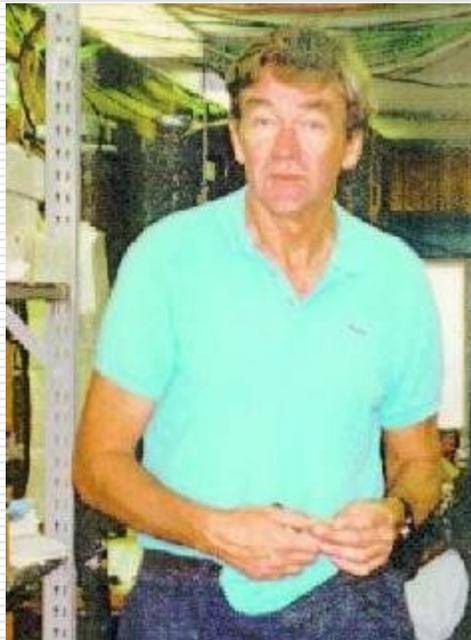
Dubna 2002

Research Topics in 2003

Field of activity	Number of topics
Theoretical physics	4
Elementary particle physics	20
Relativistic nuclear physics	11
Heavy-ion physics	3
Low- and intermediate-energy physics	3
Nuclear physics with neutrons	2
Condensed matter physics	5
Radiation and radiobiological research	2
Networking, computing, computational physics	3
Educational programme	1
Total:	54



**"I was informed by our ministry that we have to provide them by the end of the next week, 17 January 2003, with the detailed planning and budget for the coming 10 years."
Albrecht Wagner**



"The main science problems to be tackled in Particle Physics are the **origin of mass; nature of spin; fundamental symmetries (chiral symmetry), nature of dark matter; neutrino mass; deconfinement; search for supersymmetry, etc. "
Timothy Hallman**

**"I cannot find an experimenter who would agree to verify symmetry with respect to the Poincaré group."
James Bjorken**

Delegation from China at JINR



Academician Zhou Guanzhao, President of China Association for Science and Technology, visited JINR on 27 June 2002

Visit to China



**Annual Meeting of the Chinese Association for Science and Technology.
4-7 September 2002.**



**Meeting with Xu Guanhua, Minister of science and technology of China.
Beijing, 9 September 2002.**

Delegation from India at JINR



सत्यमेव जयते
भारत सरकार

Government of India

Department of Atomic Energy

Dr. D.D. Bhawalkar, Director of Centre for Advanced Technology, visited JINR on 27 September 2002

I am happy to say that DAE and DST have agreed in principle for India becoming an Associate Member of JINR.

Meetings in Spain



**Meeting with Professor Rolf Tarrach,
President of the "Consejo Superior de Investigaciones Cientificas"
Madrid, 26 November 2002**

Conferences held by JINR in 2002

□ 47 Conferences, Workshops, Schools,

■ ~4800 participants, including

□ 276 physicists from the JINR Member States (without Russia),

□ 275 scientists from the other countries.

□ Place:

■ 39 conferences in Dubna,

■ 8 conferences outside Dubna:
in Belarus, Czech Republic,
Greece, Mongolia, Romania,
Slovak Republic, Ukraine.

□ Topics:

■ Elementary Particle Physics: 12

■ Nuclear Physics: 8

■ Condensed Matter Physics: 3

■ Mathematics and Computing: 5

■ Schools: 7

■ Others: 12



32nd International Symposium on Multiparticle Dynamics. "Dubna", Alushta, Crimea, Ukrain. 7-13.09.2002

Science Bringing Nations Together

CERN and JINR joint exhibitions:

- 1997: University of Oslo (Norway)
- 1998: UNESCO, Paris
- 1999: UN Office in Geneva
- 2000: European Parliament in Brussels
- 2001: Russian State Duma
- 2002: Romania

Science Bringing Nations Together



Romania, Bucharest, 11-18 June 2002

Guest of Honour at JINR



Visit of S.M. Mironov,
the Chairman of the Federation Council
of the Federal Assembly
of the Russian Federation



FLNR, JINR, 29 November 2002

Guest of Honour at JINR



Yu. Baturin,
the Russian
astronaut.

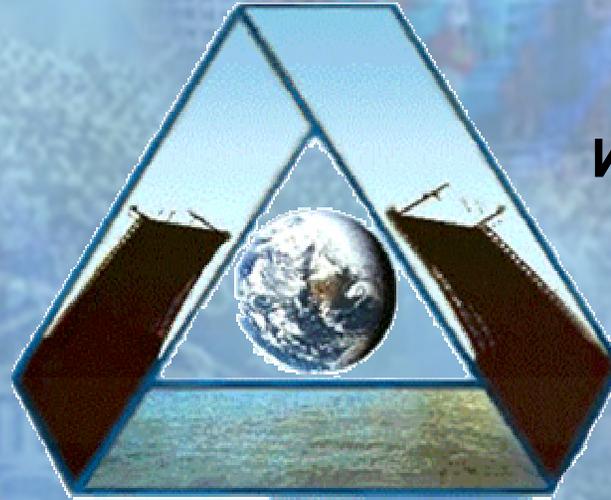


V. Trubnikov,
First Deputy Minister
of Foreign Affairs of Russia.



FLNR, JINR, 23 December 2002

**Intellectual Bridge
“Russia – West:
Problems and
Perspectives”**



**Интеллектуальный мост
“Россия – Запад:
проблемы и
перспективы”**



**Dubna, Moscow Region, 24-27 December 2002
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