Progress of implementation of the recommendations of the 109th session of the Scientific Council and of the decisions of the session of the Committee of Plenipotentiaries of the Governments of the JINR Member States (March 2011)

M. Itkis

110th SESSION of the SCIENTIFIC COUNCIL
15-16 September 2011

CONTENTS

- General Information on the Session of the Committee of Plenipotentiaries (March 2011)
- Highlights of 2011
- Implementation of the Recommendations of the 109th Session of the Scientific Council: Current Results of JINR Activities
- Latest Events and News in Brief

Session of the Co
Plenipotentiaries (M

A regular session of the Committee of Plenipotentiaries of the Governments of the JINR Member States was held in Dubna on 25–26 March 2011. It was chaired by the Plenipotentiary of the Slovak Republic, Prof. S. Dubnička.

Agenda Issues

M. Itkis: Recommendations of the 109th session of the JINR Scientific Council (February 2011). Major results of JINR's activity in 2010 and plans for 2011

N. Pershay: Results of the meeting of the JINR Finance Committee held on 22–23 March 2011

A. Sedyshev: Results of the audit of the Institute financial activity for the year 2009

V. Katrasev: Execution of the JINR budget in 2010

S. Dubnička: Election of the Director of JINR

R. Lednický: Scientific report "Results of experiments at the LHC"

Directorate's report

The CP:

- Noted the information by the JINR Directorate about the recommendations of the 109th session of the Scientific Council
- Appreciated the successful implementation of activities under the first year of the Seven-Year Plan for the Development of JINR (2010–2016)
- Recognized the achievements of JINR scientists in implementing the research programmes and in updating the accelerator and reactor base of the Institute in 2010
- Appreciated the successful start of physics experiments at the upgraded Nuclotron
- Emphasized that it looks forward to the successful beginning of physics experiments at the IBR-2M reactor in 2011
- Commissioned the JINR Directorate to concretize in the near future the scope and areas of JINR's participation in the programme of upgrades of the LHC and its detectors (in accordance with the recommendations of the Scientific Council).

Election of the JINR Director

The Committee of Plenipotentiaries:

In an open ballot, elected unanimously Professor Victor Matveev as Director of JINR for a term of 5 years, in accordance with the JINR Charter and the Regulation for the Director of JINR.

Extended the terms of office of Vice-Director M.Itkis, Vice-Director R.Lednický, Chief Scientific Secretary N.Russakovich, and of Chief Engineer G.Shirkov until the assumption of office by V.Matveev as Director of JINR on 1 January 2012.

Prime Minister of the Russian Federation Vladimir Putin visits Dubna/JINR 5 July 2011

Highlights of 2011

Vladimir Putin held a Session of the Government Commission on High Technology and Innovation

and visited the Veksler and Baldin Laboratory of High Energy Physics

Prime Minister of the Republic of Kazakhstan Karim Massimov visits JINR

11 July 2011

Highlights of 2011

Meeting with the JINR Directorate

The Kazakhstan delegation visited two JINR laboratories

IUPAC Technical Report

"Discovery of the elements with atomic numbers greater than or equal to 113"

JINR DUBNA 55 1956 - 2011

Highlights of 2011

Pure Appl. Chem., Vol. 83, No. 7, pp. 1485–1498, 2011.

The IUPAC/IUPAP Joint Working Party (JWP) on the priority of claims to the discovery of new elements 113–116 and 118 has reviewed the relevant literature pertaining to several claims.

It was determined that the Dubna-Livermore collaborations share in the fulfillment of those criteria both for elements $Z = 114$ and 116.

Implementation of the Recommendations of the 109th Session of the Scientific Council: Current Results of JINR Activities

The agenda of the current session is largely based on the recommendations of the previous session and includes the following reports:

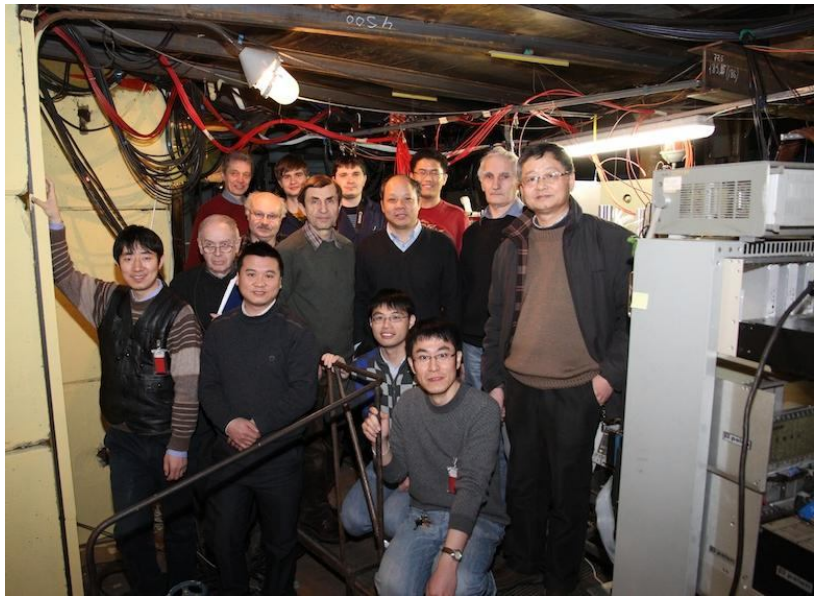
- **Preparation of the IBR-2 modernized reactor for the start of experiments in 2011.**
- **Effectiveness of the proton therapy delivered at JINR and plans for wide application in cooperation with other international centres.**
- **JINR–GSI collaboration in the field of relativistic heavy-ion physics, including proposals for its intensification.**
- **Possibilities for further intensification of the JINR Educational Programme.**

Current results of JINR activities

Particle Physics and High-Energy Heavy-Ion Physics

Nuclotron run № 43 (21 February - 22 March 2011)

- Total duration: 700 hours (~50% for physicists):
  - Gamma-3 (Belarus, Poland, Czech Rep., Greece, Germany, Bulgaria)
  - MPD @ Strela (Russia, China, Germany)
  - Delta & LNS
  - FAZA
  - NIS-GIBS
  - KVINTA



MPD & STRELA teams

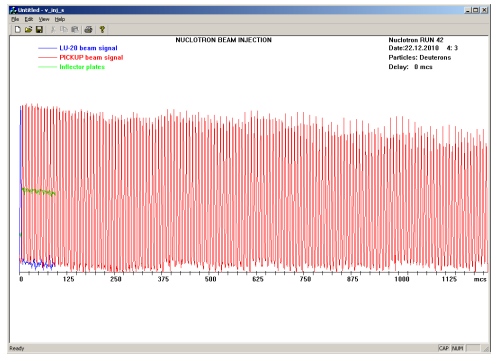
Nuclotron run № 44 planned in Nov-Dec 2011

- Duration: ~ 1.5 months

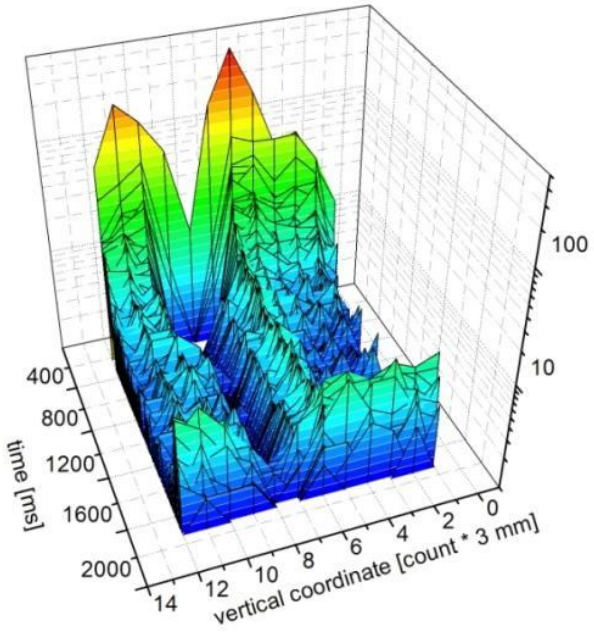
beam will be delivered mainly for physicists.

Nuclotron run № 43 (21 February - 22 March 2011)

Nuclotron-M results:



- Measured average vacuum in the Nuclotron ring is better than $4*10^{-10}$ Torr (improved > 2 orders);
- For the first time beam slow extraction at 3.1 GeV/n was performed;
- Stable operation was demonstrated with beam intensity $4.5 - 5 \cdot 10^{10}$ (d) at 300 MeV/n;



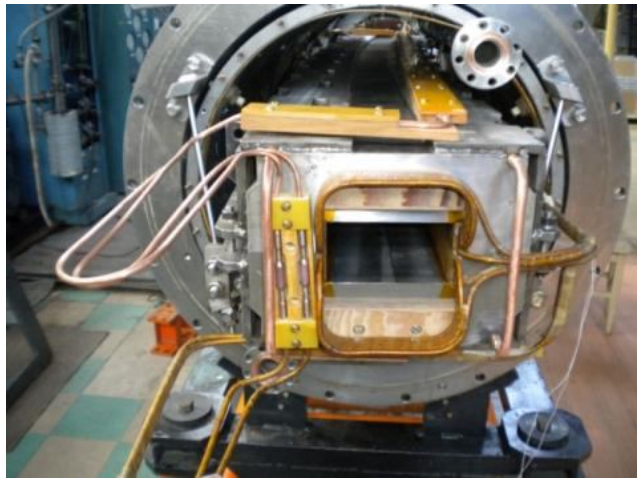
Installed and put into operation:

- new digital system for online beam orbit measurement;
- automatic beam orbit correction system (28 correctors);
- system to monitor the beam profile evolution (transverse & longitudinal) during acceleration

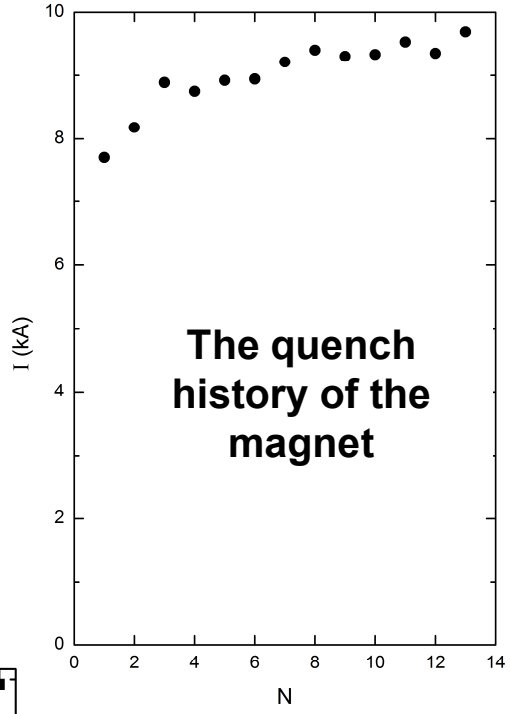
Nuclotron-NICA status

- Heavy Ion Linac for 3MeV/u (new energy concept) is at design stage;
- KRION-6T superconducting coil tests:
  - ✓32 layers (25 Apr.'11) – 7.81T at I_crit=114 A – succesfuly tested;
  - ✓expected for Krion-6T ESIS – 22 layers, L=120 cm, B=6 T @ I =118 A. (Sept'11)
- Source of polarized particles (p, d, H) JINR + INR RAS:
  - ✓ plans: to assemble and TEST SPP at the Nuclotron with ↑d in the end of 2012
- Stochastic cooling system prototype:
  - ✓ is on the way to be assembled and tested at the Nuclotron at the end of 2011
- Test bench for injection system (inflector plates) into Booster is in operation;
- Prototype of HV platform for Ion sources (PS 225kV/3A) is under assembly;
- Work on the new thermometry and quench detection system for the Nuclotron is in progress
- New system of the NICA complex synchronization is under design and construction;
- Development of the e-cooling system for booster is in active phase. HV e-cooling system for collider is under design.

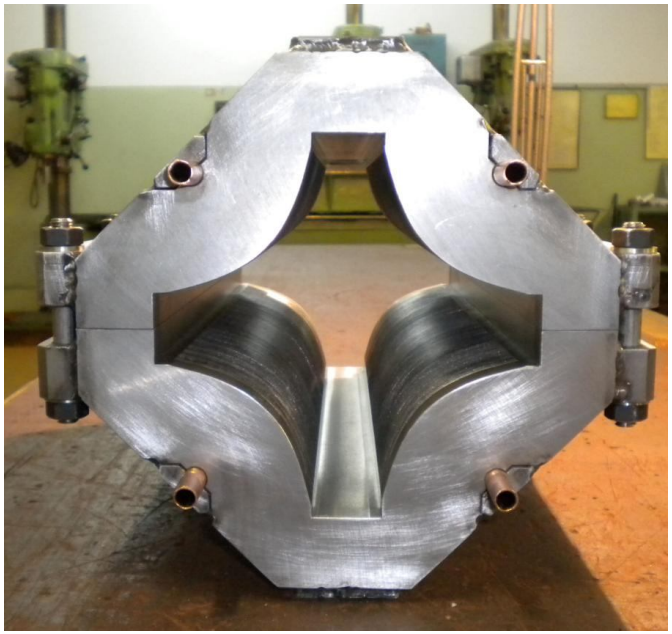
Status of the Superconducting Magnets for NICA Booster and Collider



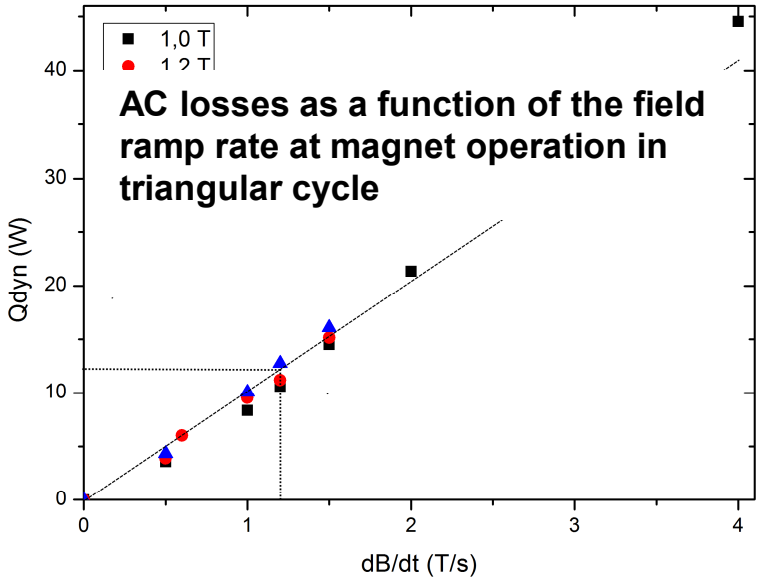
Installation of the cryostat with the magnet on the bench for the cryogenic test.



The quench history of the magnet



Booster quadrupole magnet at workshops



Collider dipole prototype magnet at vacuum tests

NICA MAC meeting on 7 June 2011

10 MAC members participated:

B.Sharkov (FAIR),
M.Steck (GSI),
Yu.Senichev (FZJ),
R.Stassen (FZJ),
A.Fedotov (BNL),
S.Nagaitsev (FNAL),
V.Lebedev (FNAL),
V.Yarba (FNAL),
P.Belochitskii (CERN),
P.Zenkevich (ITEP)

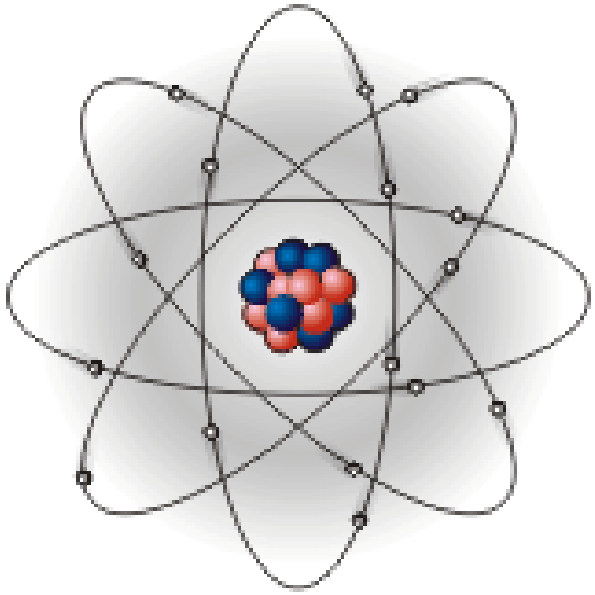
Summary of the NICA MAC meeting (7 June 2011)

- Progress of the project is very clear. MAC was impressed by the Nuclotron development and improvements. It is a demonstration that there is a very competent core group of accelerator physicists and engineers at JINR.
- NICA Booster concept and parameters look well-developed.
- The design of the NICA collider is progressing well.
- The FODO structure was selected as preferable due to less circumference and sufficiently simpler injection scheme.
- The key problem for the NICA collider is beam cooling, both electron and stochastic. The NICA management should organize a special workshop to clarify the role and select the design of the cooling systems.

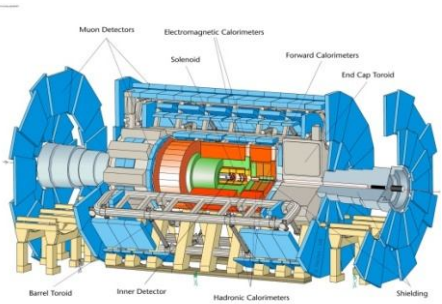
The MAC recommends that the JINR Directorate provide the required finance profile and manpower for the project realization in accordance with the schedule of construction and commissioning.

External Activities in Particle Physics

Several results in physics obtained with strong involvement of VBLHEP and DLNP research groups



JINR's participation in the ATLAS experiment



Search for chiral vector W*- and Z*-bosons was carried out at the LHC.

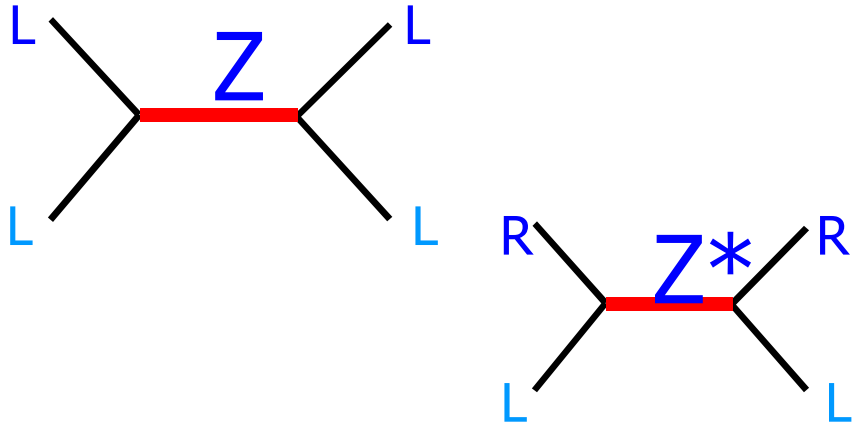
The inclusive high-mass lepton pair production ($pp \to W^*/Z^*X \to \ell\ell'X$) was studied Unique low mass limits were obtained :

1.15 TeV for W* and 1.35 TeV for Z*-boson.

The idea of these chiral vector bosons was born in Dubna (M.Chizhov), it was proposed for ATLAS, it was accepted by the collaboration and it was realized under leadership of JINR physicists.

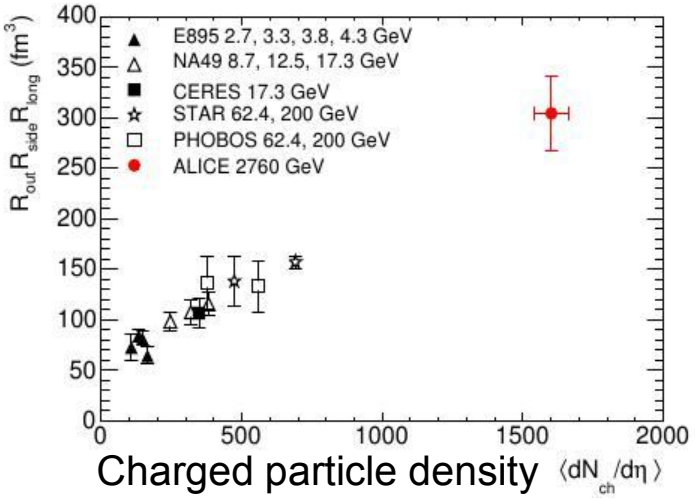
There is no relavant investigation in other LHC experiments.

There are at least three different classes of theories, all motivated by the hierarchy problem, which predict these new vector extra bosons (weak-doublets) with masses not far from the electroweak scale. These bosons have new unique property — they **change chirality** during interaction with matter.



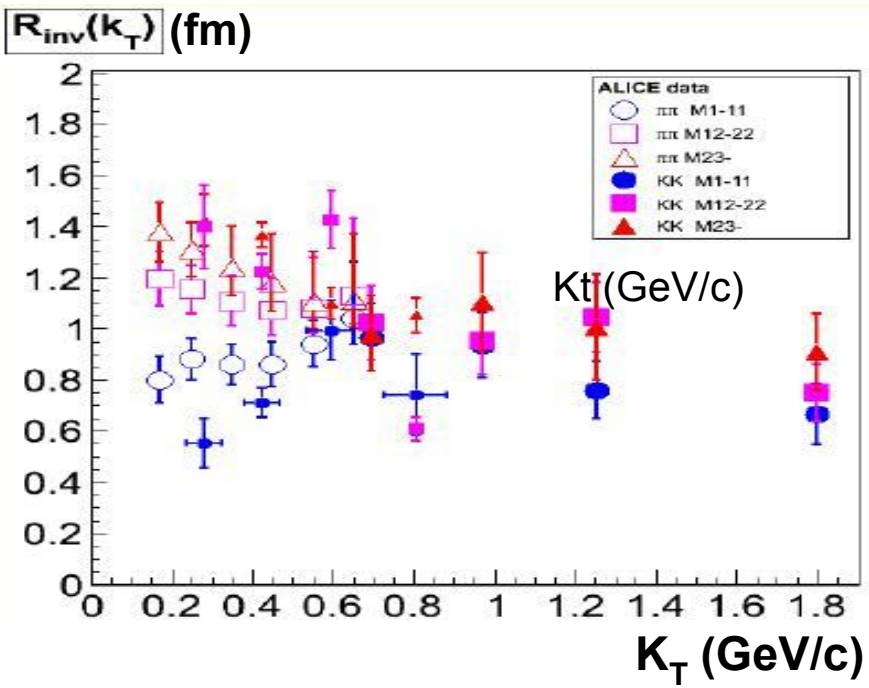
JINR's participation in the ALICE experiment

The size of particle emitting source was measured in ALICE using the method of Two-particle Bose-Einstein Correlation.



Comparison of volume particle source ($R_{out}R_{side}R_{long}$) obtained in ALICE for Pb-Pb at 2.76 TeV (per nucleon) with other experiments shows that this volume about 2 times larger , than measured in STAR and PHOBOS experiments at RHIC energy (Phys.Lett.B(2011)328).

The result of ALICE is in agreement with theoretical prediction for more hot and dense nuclear matter at LHC energy.

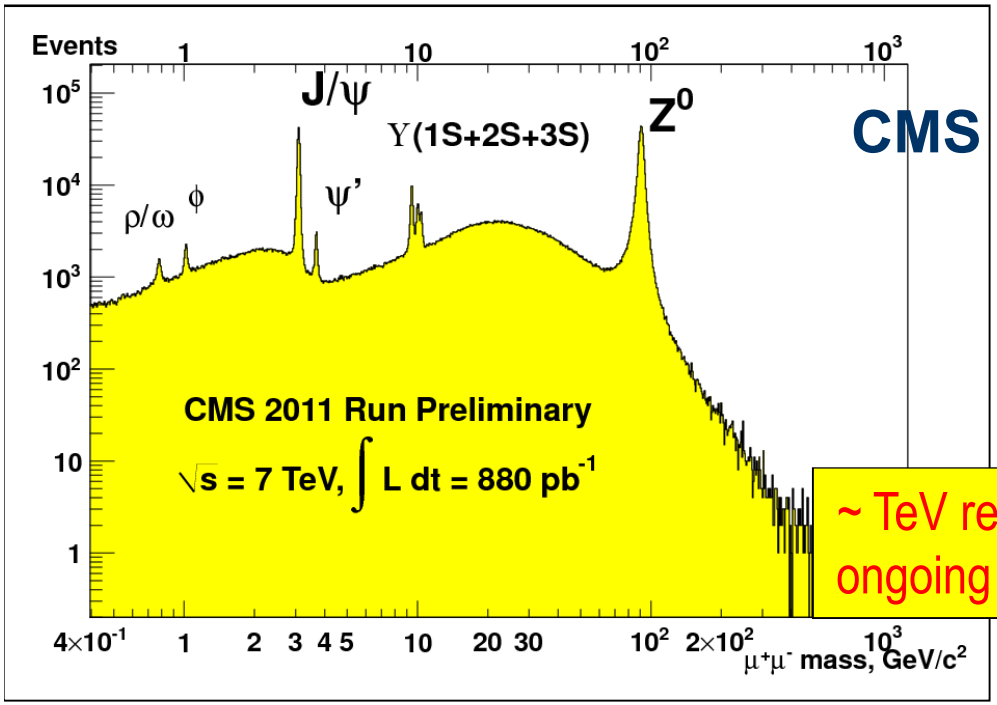


Preliminary measurement of charged kaons emitting source radius (R_{inv}) in p-p at 7 TeV was done by JINR group. These radii (small full points in Fig.) at different particle multiplicities (M) and transverse momenta (k_T) corresponds theoretically to the ones obtained for neutral kaons (large full points) but a bit larger than the radii measured for charged pions (open poins in Figure).

These results were presented by JINR Group to the Quark-Matter 2011 Conference.

JINR's participation in the CMS experiment

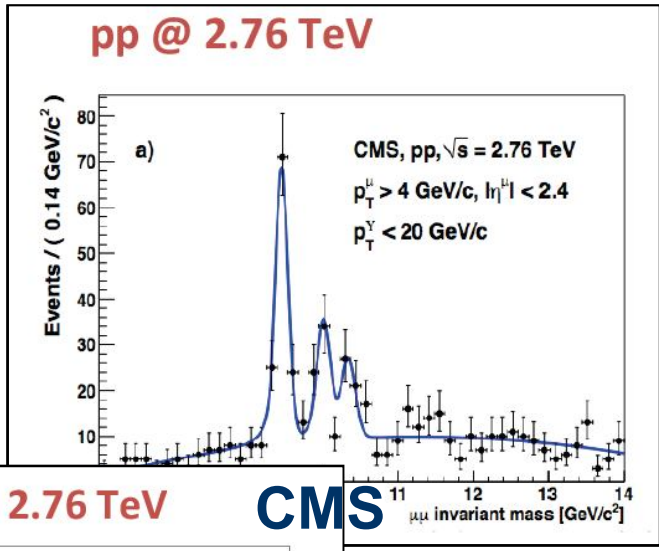
SM Rediscovery with Dimuons

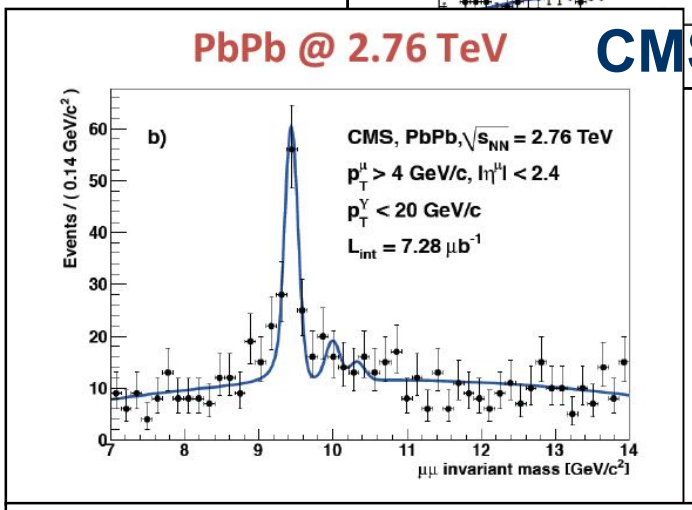


~ TeV region: ongoing work

Suppression of Excited Upsilon States In Heavy ion collisions

arXiv:1105.4894 ; CMS-HIN-11-007 ; CERN-PH-EP-2011-074





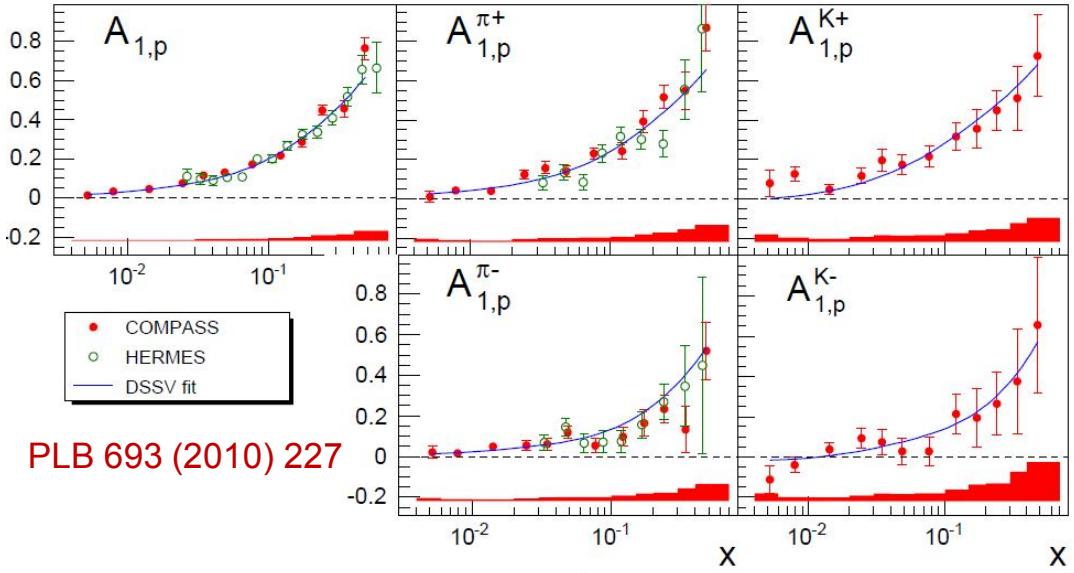
$$\frac{\Upsilon(2S+3S)/\Upsilon(1S)|_{\mathrm{PbPb}}}{\Upsilon(2S+3S)/\Upsilon(1S)|_{\mathrm{pp}}} = 0.31 \pm 0.17 \pm 0.03,$$

Beyond SM with Dimuons

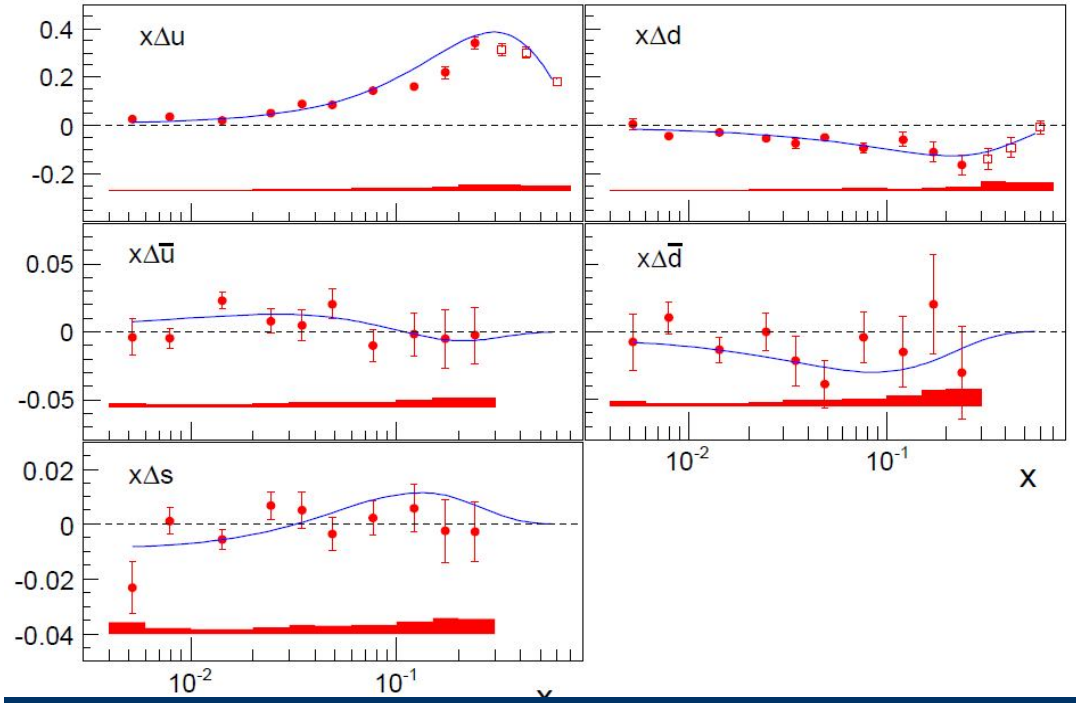
Experiment	Mass limits, GeV			Model
	$\mu^+\mu^- + e^+e^-$	$\mu^+\mu^-$	e^+e^-	
CMS	1140	1027	958	Z'_{SSM}
CMS	887	792	731	Z'_{ψ}
CMS	1079	987	931	RS1 Graviton $c = 0.1$
CMS	855	778	729	RS1 Graviton $c = 0.05$
ATLAS	1048	957	834	Z'_{SSM}

Spin physics at COMPASS.

The quark helicity distributions.



PLB 693 (2010) 227

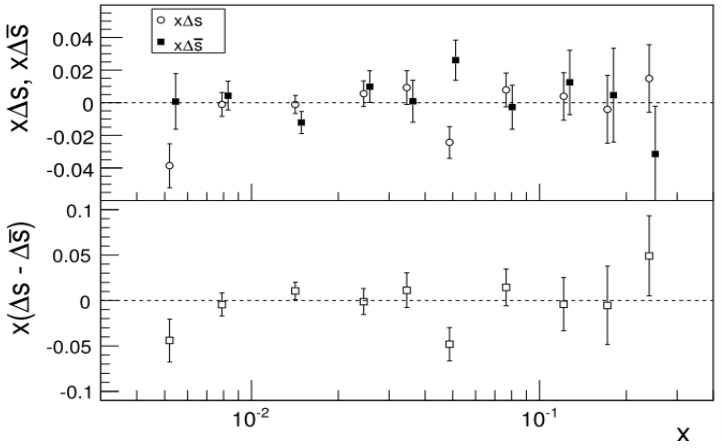


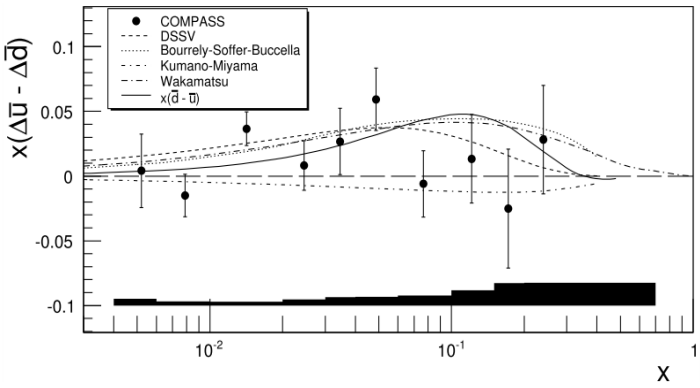
- very precise data
- only COMPASS for $x < 0.01$ ($Q^2 > 1$)
- deuteron data:

$\Delta\Sigma = 0.33 \pm 0.03 \pm 0.05$

$\Delta s + \Delta s = -0.08 \pm 0.01 \pm 0.02$

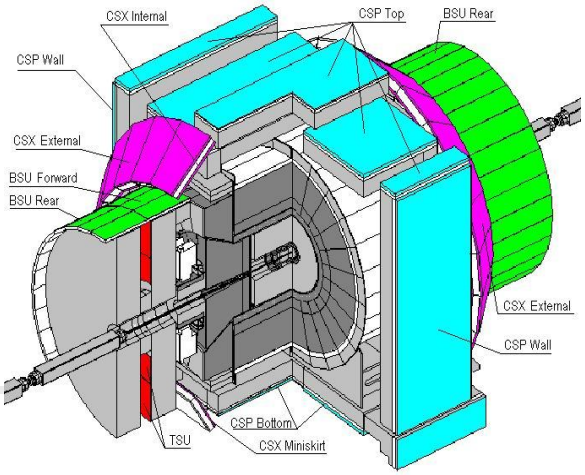
($\Delta\Sigma = a_0$, evol. to $Q^2 = \infty$)



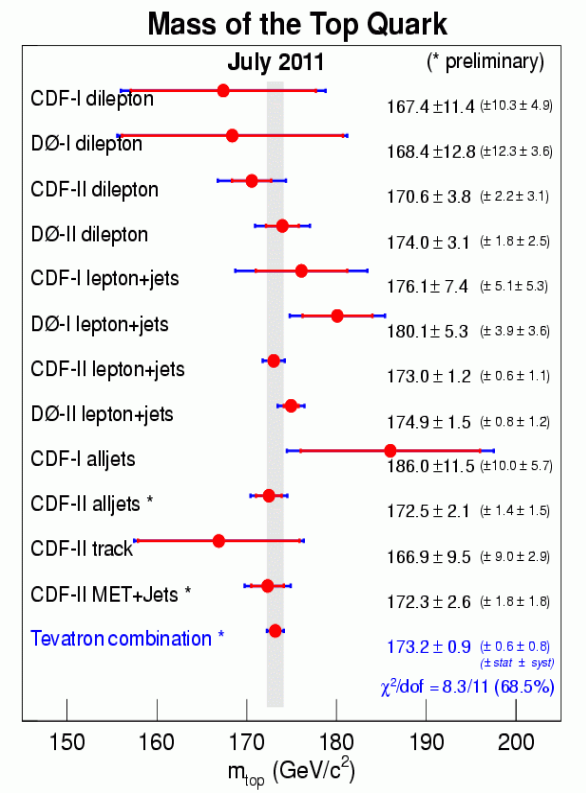


High energy physics

CDF at FNAL

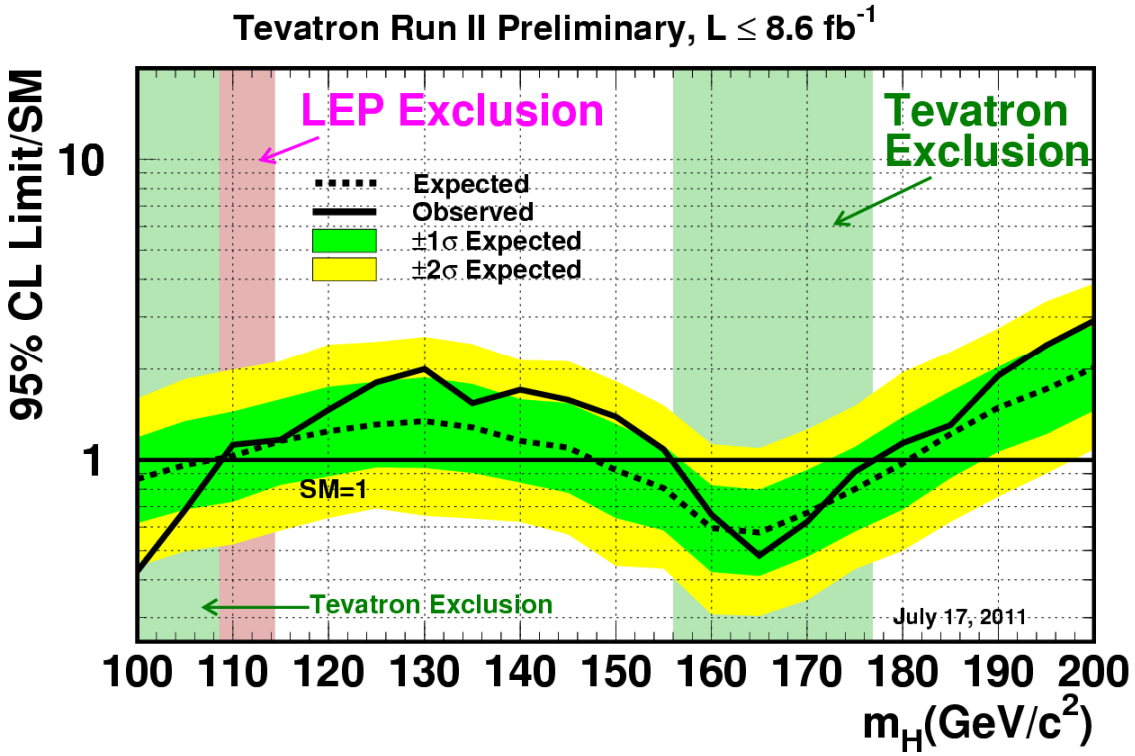


CDF top mass measurements (July 2011)



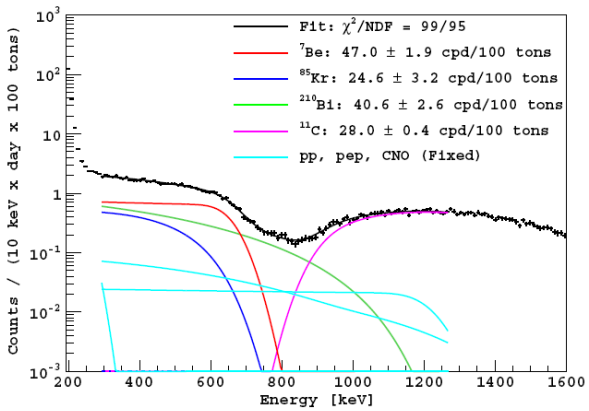
M_{top} = 173.2 ± 0.9 GeV/c^2

SM Higgs is excluded 156 and 177 GeV



Neutrino physics

BOREXINO experiment:



Solar neutrino flux measurement

Precision measurement of the ^{7}Be solar neutrino interaction rate

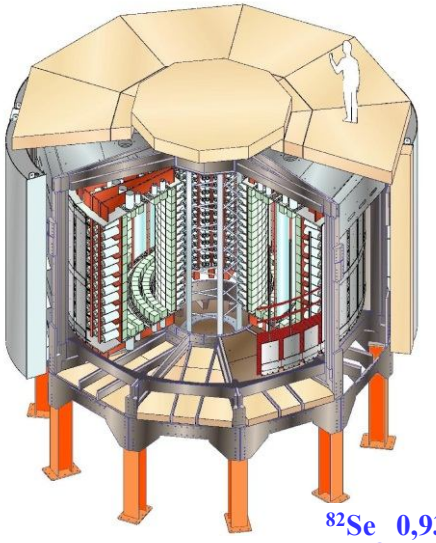
^{7}Be solar neutrino flux is measured with total uncertainty of 4.8%. Day/night variations of this flux are measured with 1% precision.

$46 \pm 1.5_{stat}{}^{+1.6}_{-1.5\ syst}$ cpd/100t

Absence of day/night asymmetry of 862 keV ^{7}Be solar neutrino rate in Borexino and MSW oscillation parameters

A(d/n) = 0.001 ± 0.012 (stat) ± 0.007 (syst)

NEMO 3 experiment



^{116}Cd 405 г
$Q_{\beta\beta}$ = 2805 кэВ

^{96}Zr 9,4 г
$Q_{\beta\beta}$ = 3350 кэВ

^{150}Nd 37,0 г
$Q_{\beta\beta}$ = 3367 кэВ

^{48}Ca 7,0 г
$Q_{\beta\beta}$ = 4272 кэВ

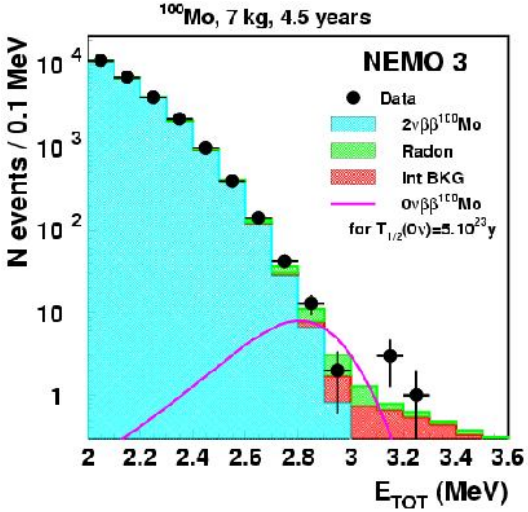
^{130}Te 454 г
$Q_{\beta\beta}$ = 2529 кэВ

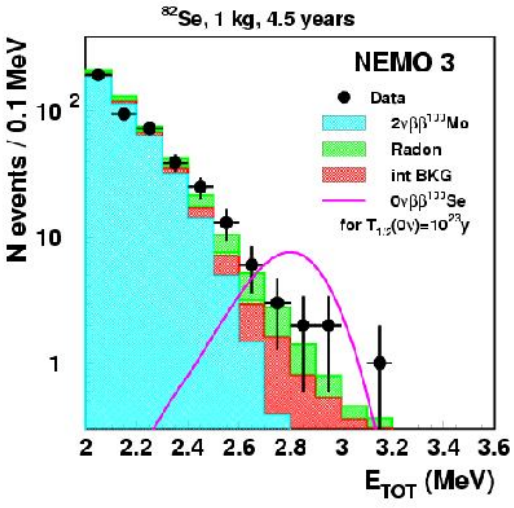
^{100}Mo 6,914 кг
$Q_{\beta\beta}$ = 3034 кэВ

^{82}Se 0,932 кг
$Q_{\beta\beta}$ = 2995 кэВ

Present limits: $\langle m_\nu \rangle < 0.47–0.96$ eV

Expected by 2014: $\langle m_\nu \rangle < 0.06–0.1$ eV





Current results of JINR activities

Nuclear Physics and Low-Energy Heavy-Ion Physics

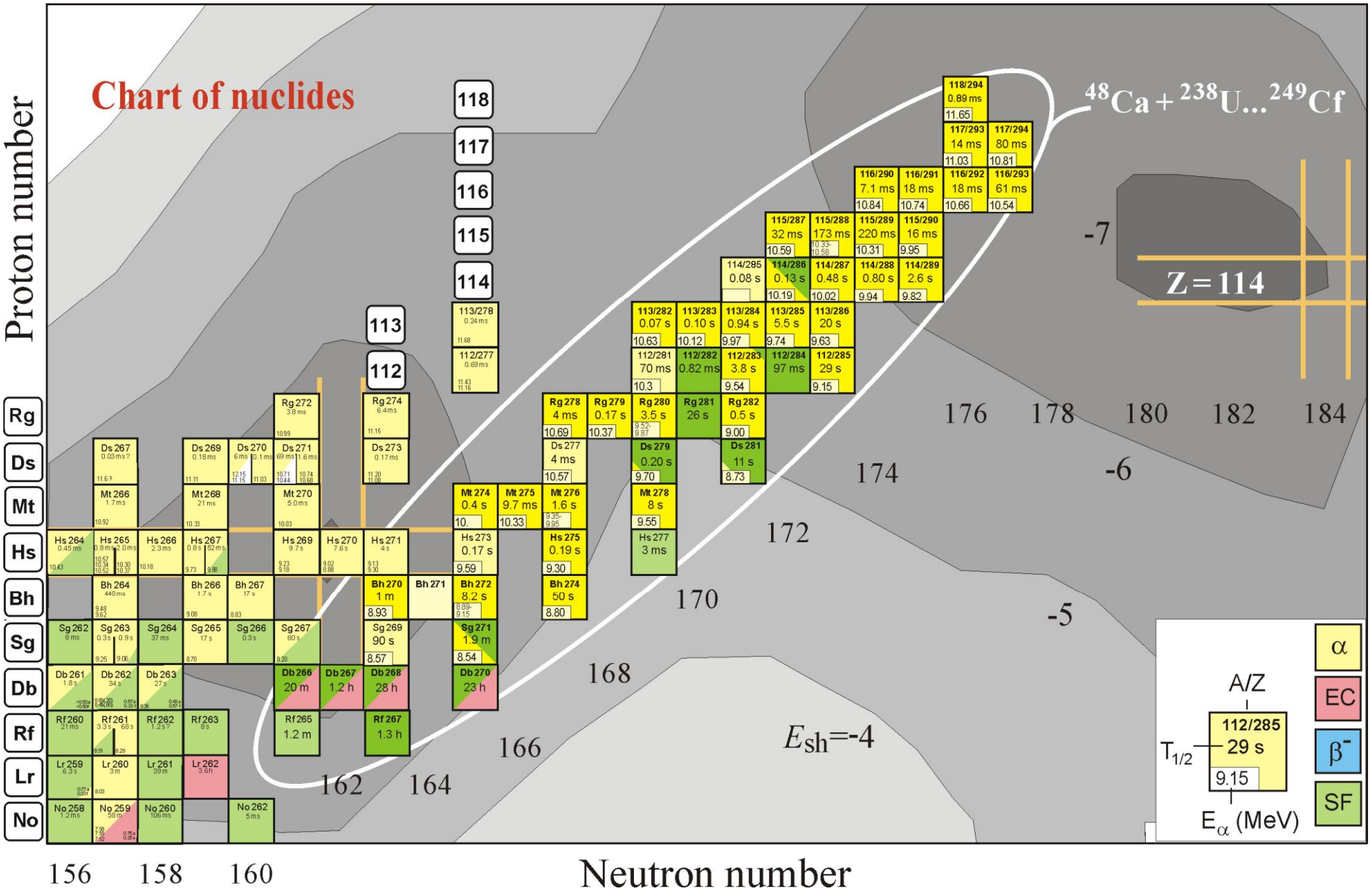
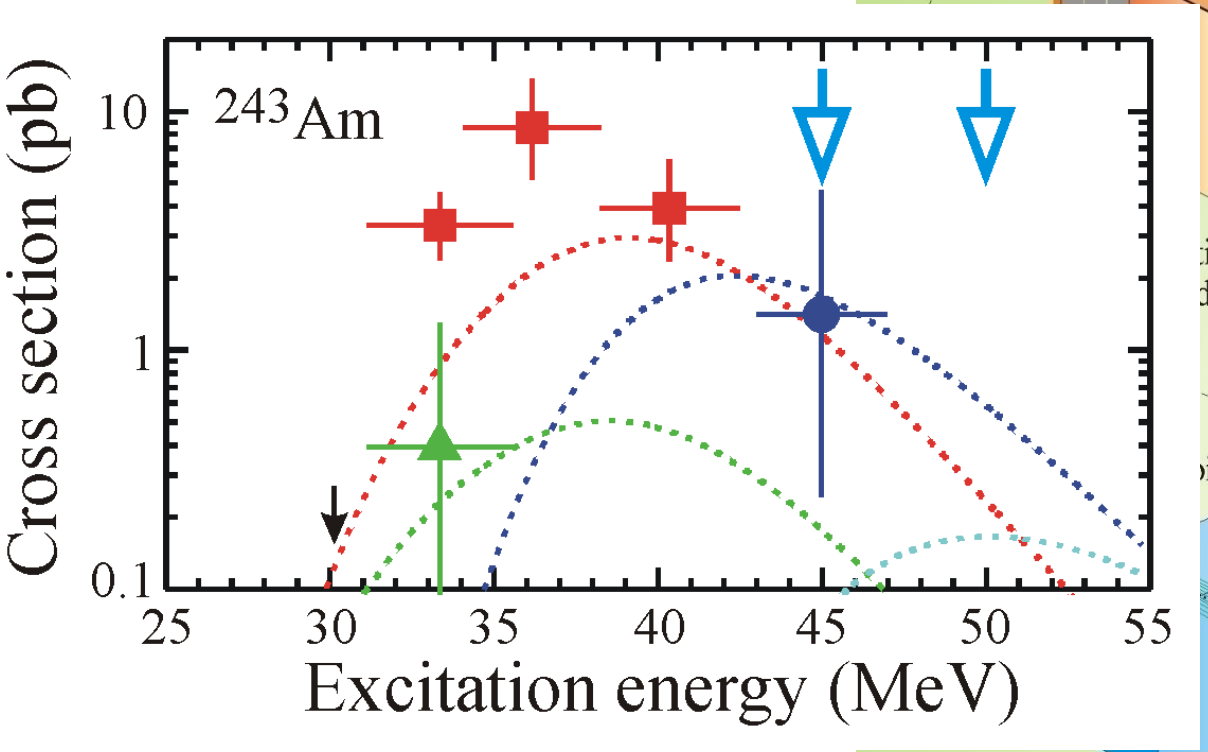
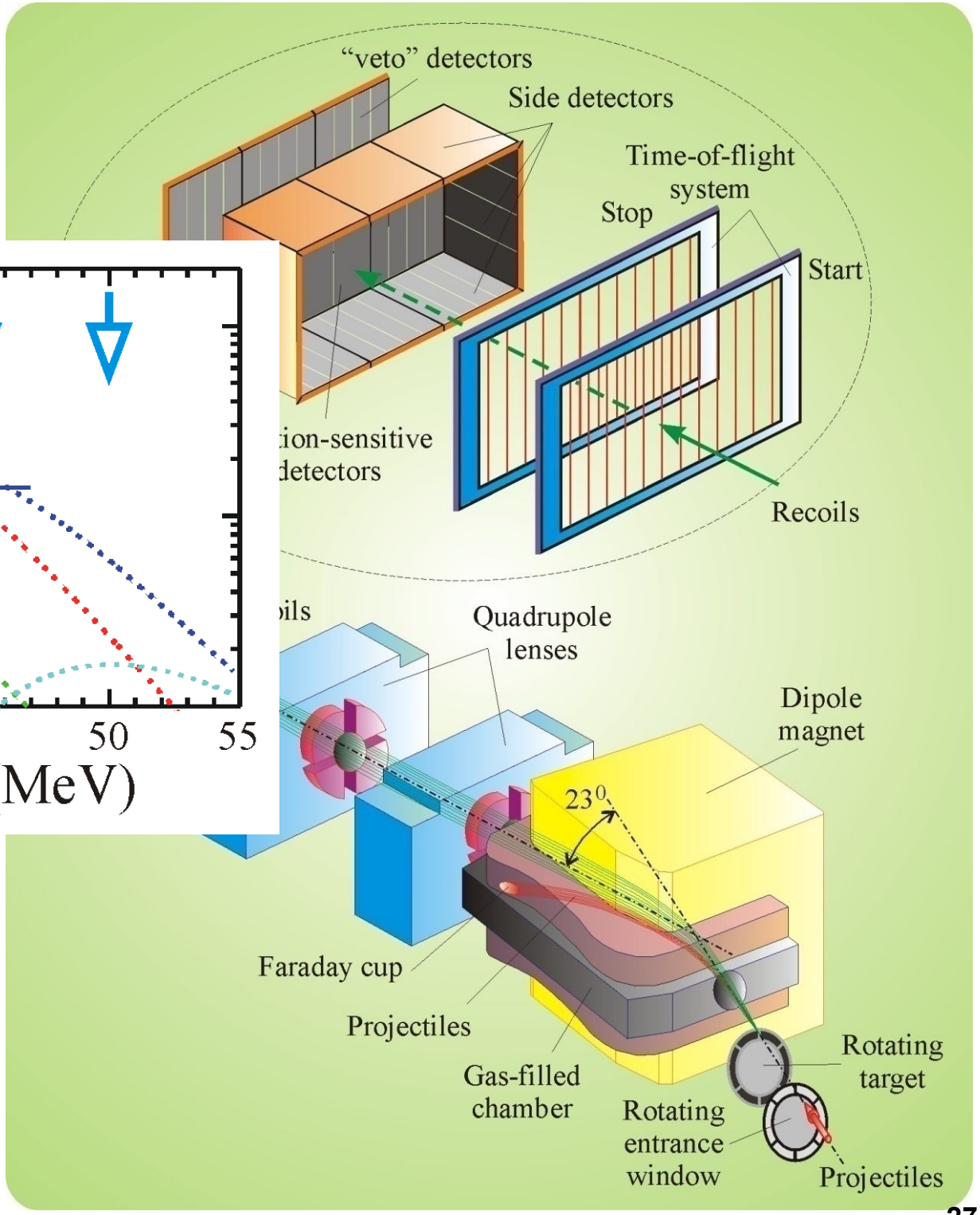


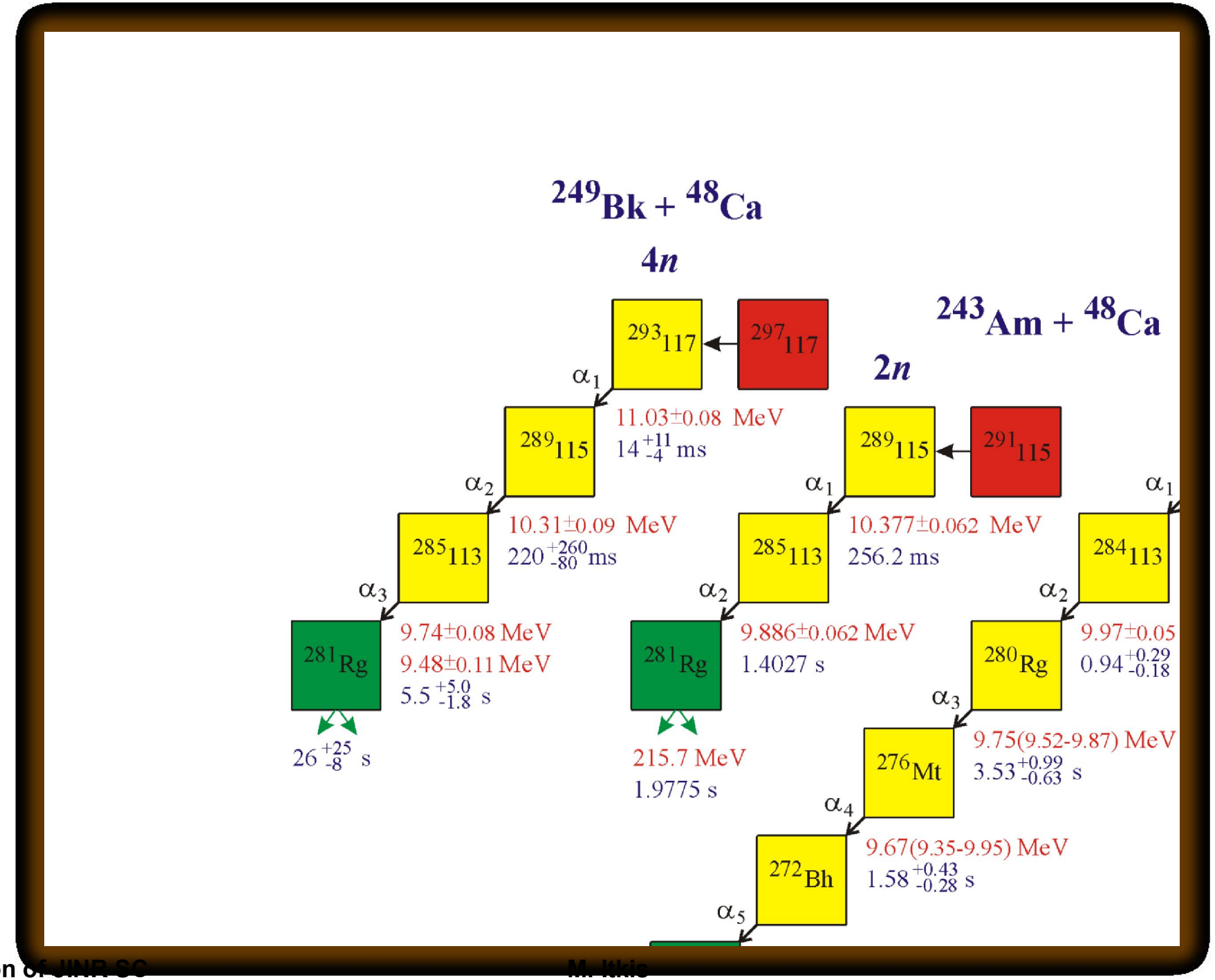
Chart of nuclides
$^{48}Ca + ^{238}U ... ^{249}Cf$
Z = 114
-7
-6
-5
E_{sh}=-4
Proton number
Neutron number
Rg
Ds
Mt
Hs
Bh
Sg
Db
Rf
Lr
No
118
117
116
115
114
113
112
156
158
160
162
164
166
168
170
172
174
176
178
180
182
184
A/Z
$T_{1/2}$
112/285
29 s
9.15
E_α (MeV)
α
EC
β^-
SF

Gas-Filled Recoil Separator

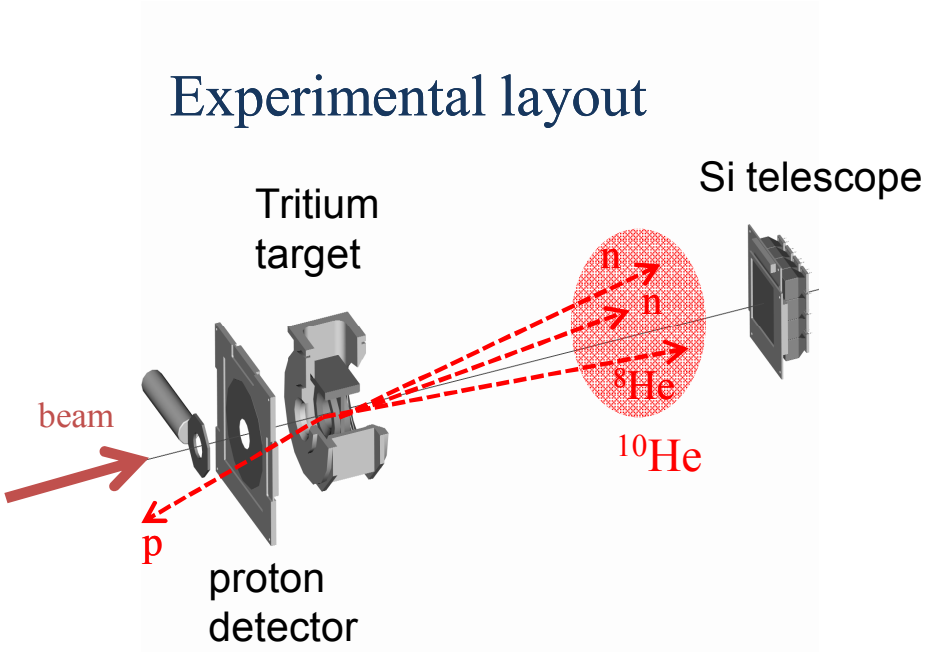


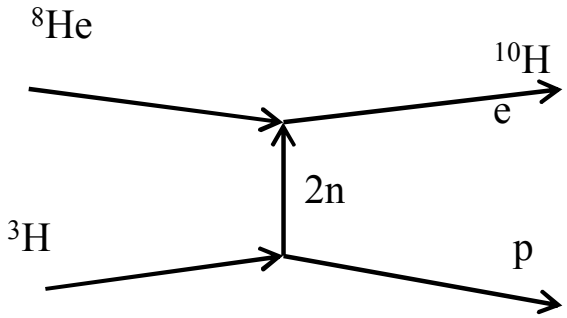


Confirmation of the 117th!

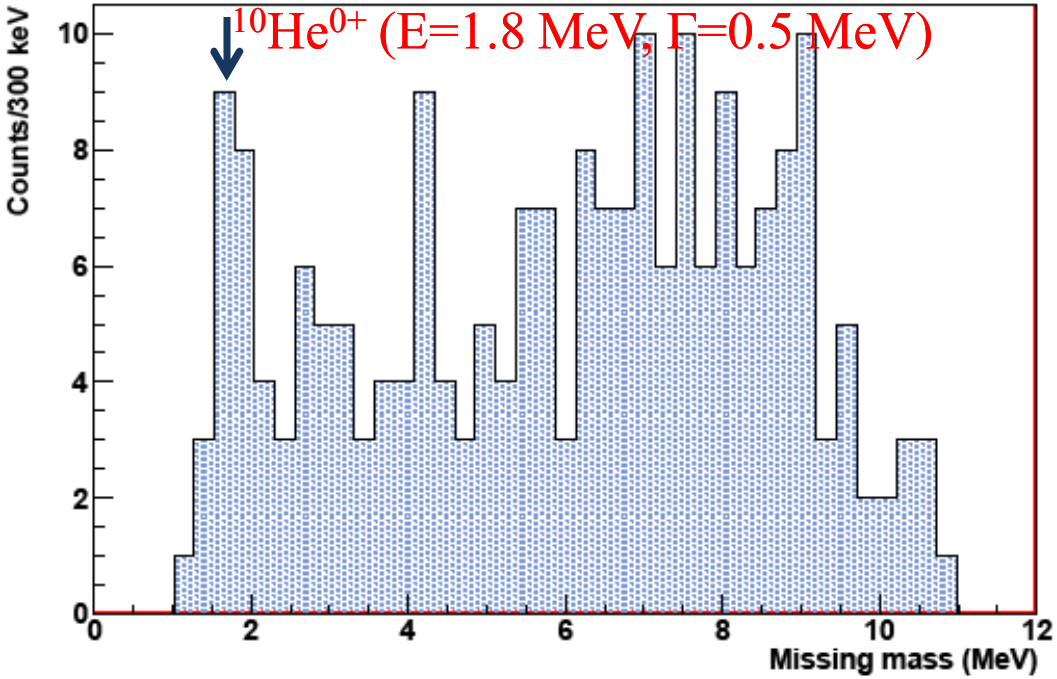


Studies with radioactive beams: properties of superheavy helium ^{10}He

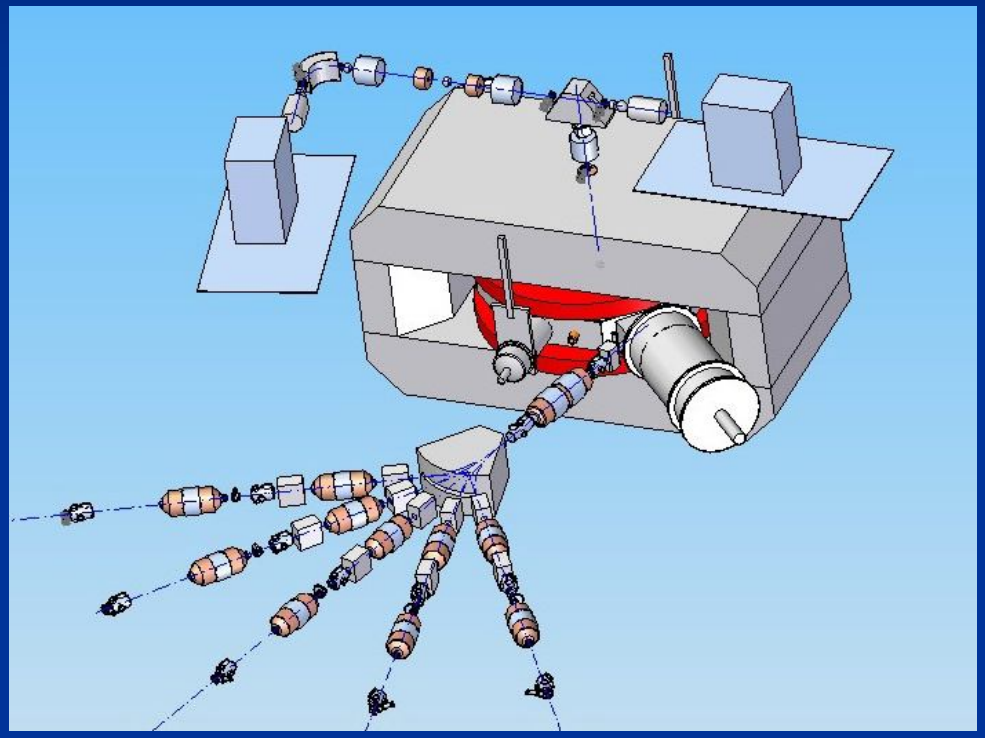




Reaction: ^{3}H(^{8}He,p)^{10}He
Secondary radioactive beam ^{8}He
Cryogenic tritium target



DC-280 cyclotron



Ion source	DECRIS-4 - 14 GHz DECRIS-SC3 - 18 GHz
Injecting beam potential	Up to 100 kV
A/Z range	4÷7
Energy	4÷8 MeV/n
Magnetic field level	0.6÷1.35 T
K factor	280
Gap between plugs	400 mm
Valley/hill gap	500/208 mm/mm
Magnet weight	1000 t
Magnet power	300 kW
Dee voltage	2x130 kV
RF power consumption	2x30 kW
Flat-top dee voltage	2x14 kV

Current results of JINR activities

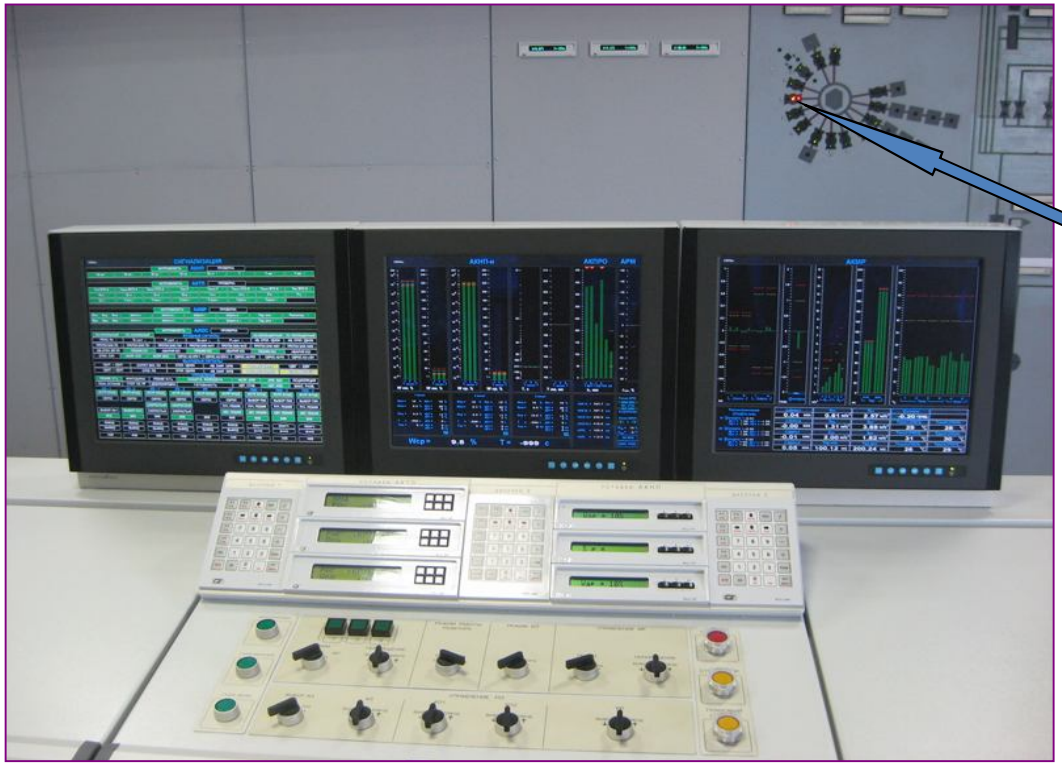
Condensed Matter Physics

9 June 2011:
the activities on the physical start-up of the IBR-2 reactor were successfully completed

<u>29 June 2011 (JINR):</u> Meeting of the State Acceptance Commission on the readiness for the start-up of the IBR-2 reactor. It took the following decision:

"The modernized IBR-2 reactor is ready for the power start-up".

5 July 2011:
Activities on the power start-up were started



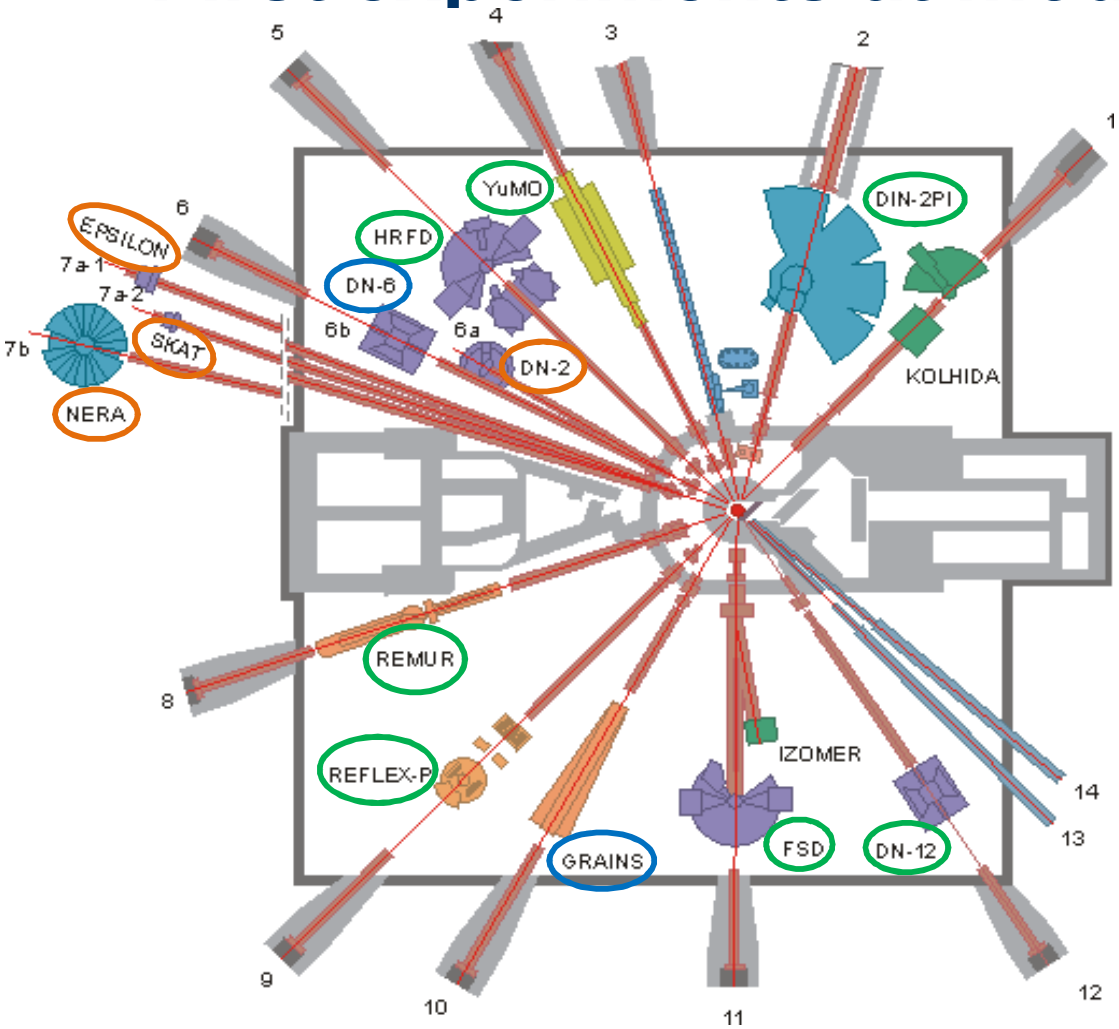
8 July 2011:
Mean power (W) = 300 kW

Indication of the beam shutters at the operator control desk. Beam 5 is open.

For the first time since December 2006 a beam line is open!

21 July 2011:
Mean power (W) = 1 MW

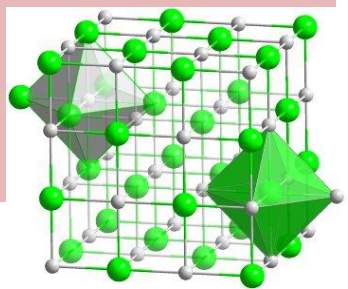
First experiments at modernized IBR-2 reactor



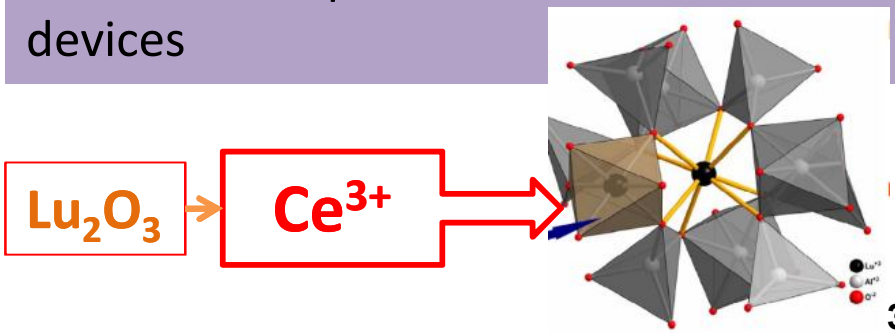
Spectrometers prepared for commissioning at the power start-up of IBR-2M:
YuMO, HRFD, REMUR, REFLEX, FSD, DN-12, DIN-2PI

Spectrometers in modernization and creation stages:
DN-2, SKAT, Epsilon, NERA-PR
DN-6, GRAINS

The comparative structural study of powder and fine-crystalline structure of microalloyed steels ‘ additive (NbC) at HRFD



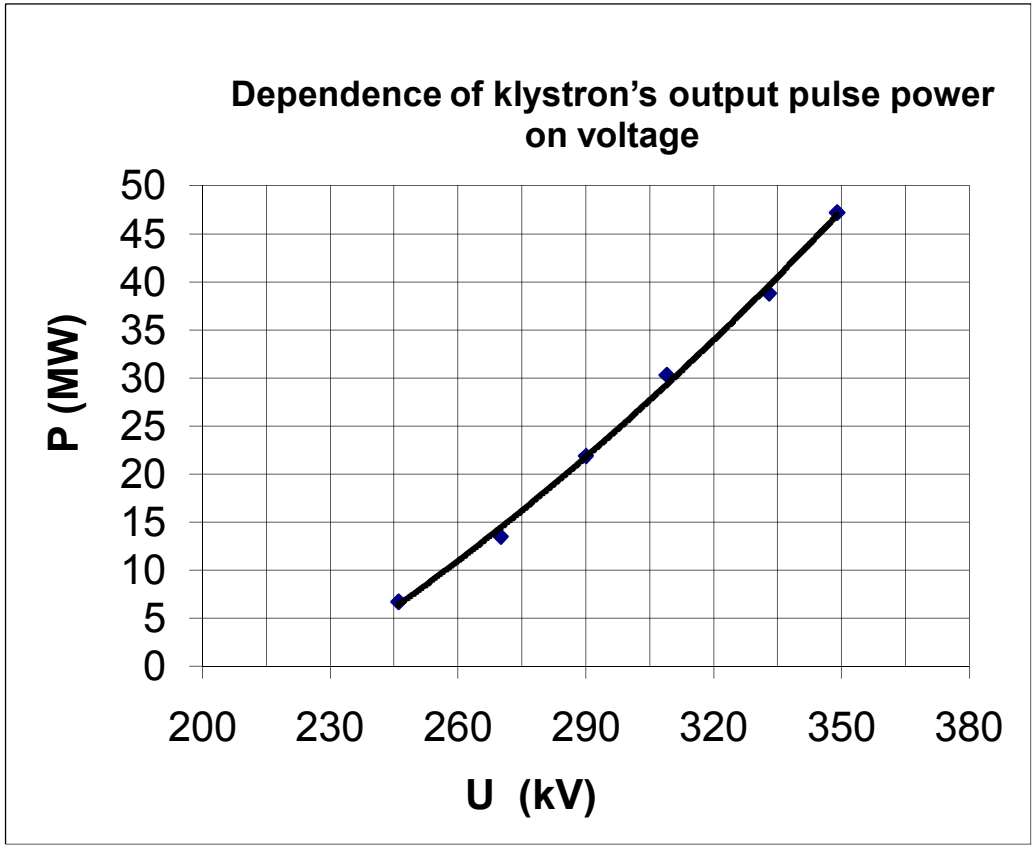
Crystal structure of prospective optically active materials ($Lu_3A_5O_{12} : Ce^{3+}$) for lasers and photoluminescence devices



IREN New Klystron Tests

Satoshi Fuji from Toshiba checking klystron parameters (June 2011)

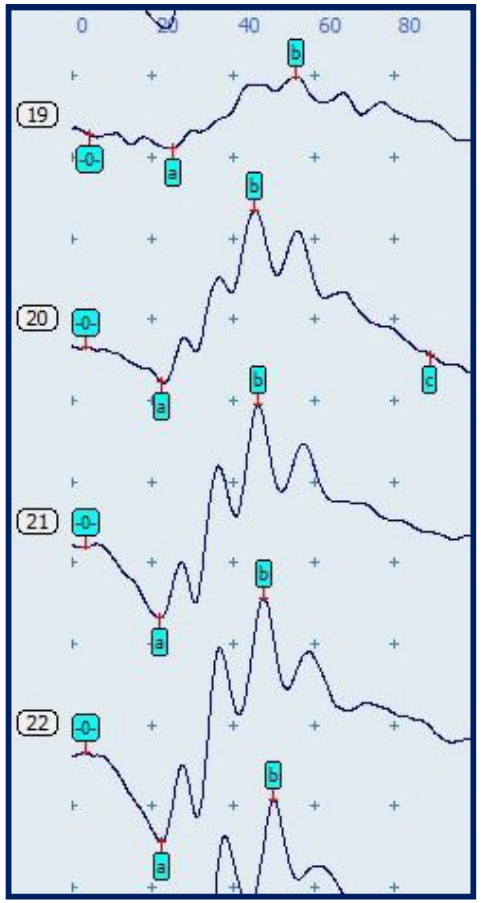
E3730A klystron peak power was measured with SLAC dummy load July 2011



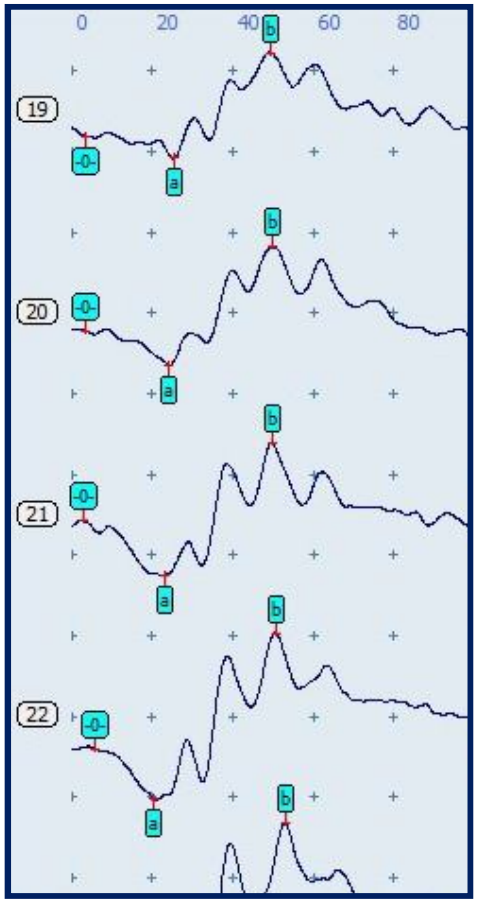
By the end of September 2011 klystron operation with accelerating section is planned

Radiobiology of vision

Studying functional and morphological changes in the mammalian retina under the effect of mutagens

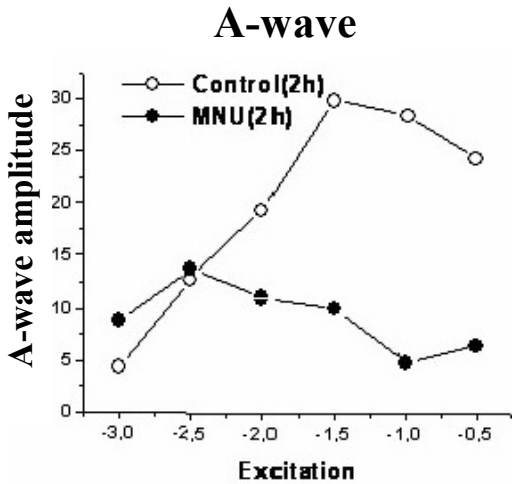


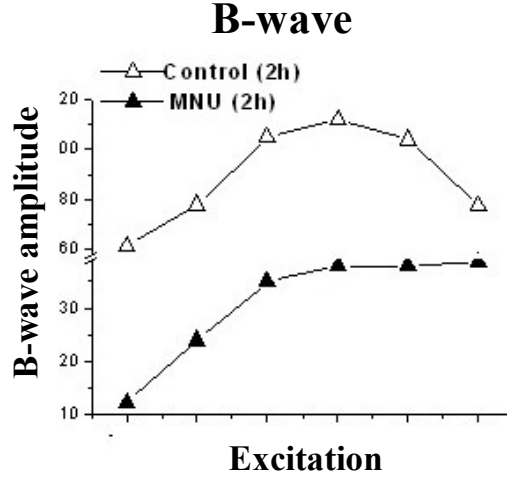
control



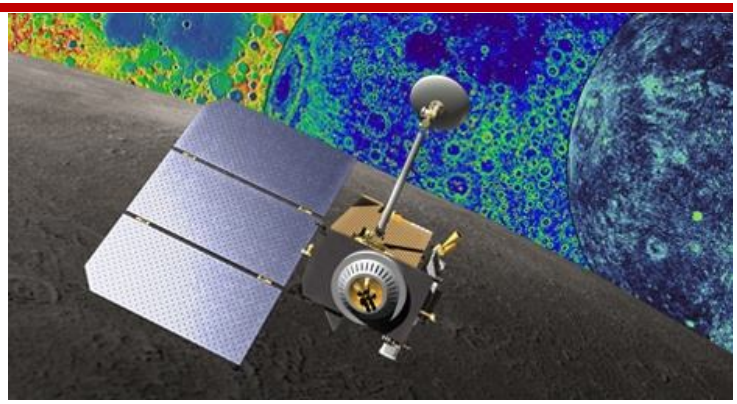
24 hours after MNU introduction

- A comparative analysis has been performed of **mouse electroretinograms** taken in the absence and presence of the mutagen methylnitrosourea (MNU) in different concentrations.
- After the introduction of the mutagen MNU in a high concentration (70 mg/kg), **a decrease in the A- and B-wave amplitude is observed.**

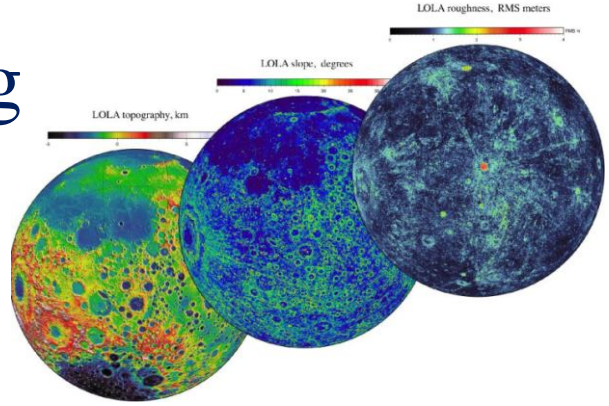




Lunar Exploration Neutron Detector for the NASA Lunar Reconnaissance Orbiter



- Global mapping of the Moon
- Radiation environment exploration
- Potential resource (water ice) prospecting



National Aeronautics and Space Administration

Presents the

Group Achievement Award

to

The Lunar Reconnaissance Orbiter (LRO) Team

For exceptional accomplishments in developing and operating the LRO spacecraft and instruments.

G. N. Timoshenko

Signed and Sealed at Washington, DC
this eleventh day of May
Two Thousand Ten

Administrator, NASA

V.N. Shvetsov (FLNP), G.N. Timoshenko, and A.R. Krylov (LRB) have been awarded NASA letters of commendation for exceptional accomplishments in developing and operating the LRO spacecraft and instruments.

Current results of JINR activities

- Theoretical Physics
- IT and Telecommunications
- Educational Programme

BLTP's Scientific Policy

Development of research in **theoretical physics**
on the basis of **advanced mathematics;**
Support of **JINR experimental programmes;**
Strengthening of the **efficiency of scientific staff** through
international cooperation and the interplay of **research and education.**

Main directions of research in 2011

Theory of Elementary Particles and Fields

Standard Model and Its Extension,
QCD Parton Distributions for Modern and Future Colliders,
Physics of Heavy and Exotic Hadrons,
Mixed Phase in Heavy-Ion Collisions.

Nuclear Theory, Nuclear Structure and Dynamics

Nuclear Structure far from Stability Valley
Nucleus-Nucleus Collisions and Nuclear Properties at the Low Energies
Exotic Few-Body Systems,
Nuclear Structure and Dynamics at the Relativistic Energies.

Theory of Condensed Matter and New Materials

Physical properties of complex materials and nanostructures
Mathematical problems of many-particle systems

Modern Mathemtical Physics

Quantum groups and integrable systems
Supersymmetry
Quantum gravity, cosmology and strings

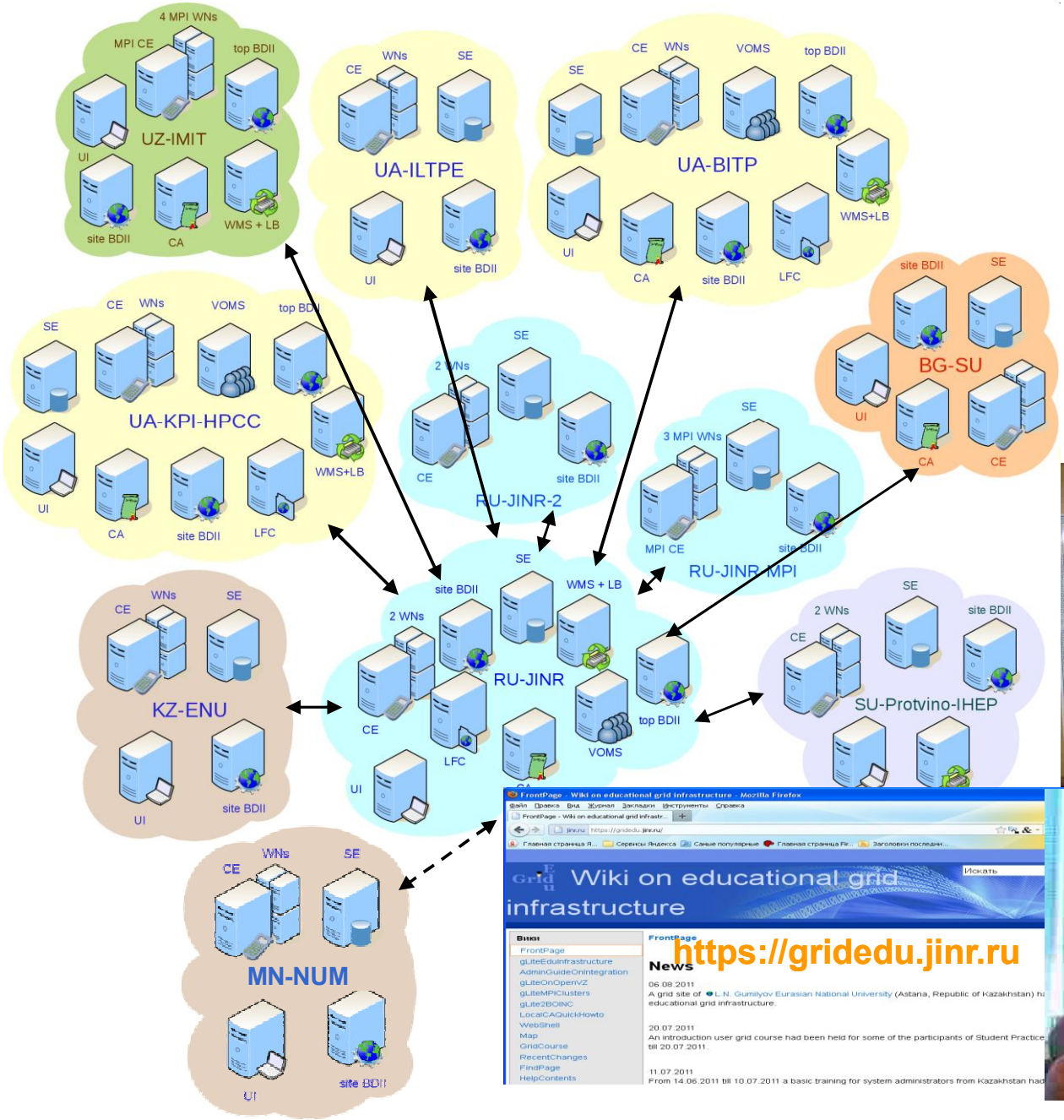
Conferences, Workshops, Schools 2011
Total - 15 (> 1000 participants)
DIAS-TH and Helmholtz Schools for young scientists (about 20 countries were represented) - 3

Publications, Jan.-Sept. 2011
Monographs ~ 3
Journals ~ 185
Total ~ 340

More than 50 lecture courses at JINR UC, DIAS-TH, Moscow U., Dubna U., MPTI, etc.

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

JINR Grid infrastructure for training and education – construction of JINR Member States' Grid infrastructure

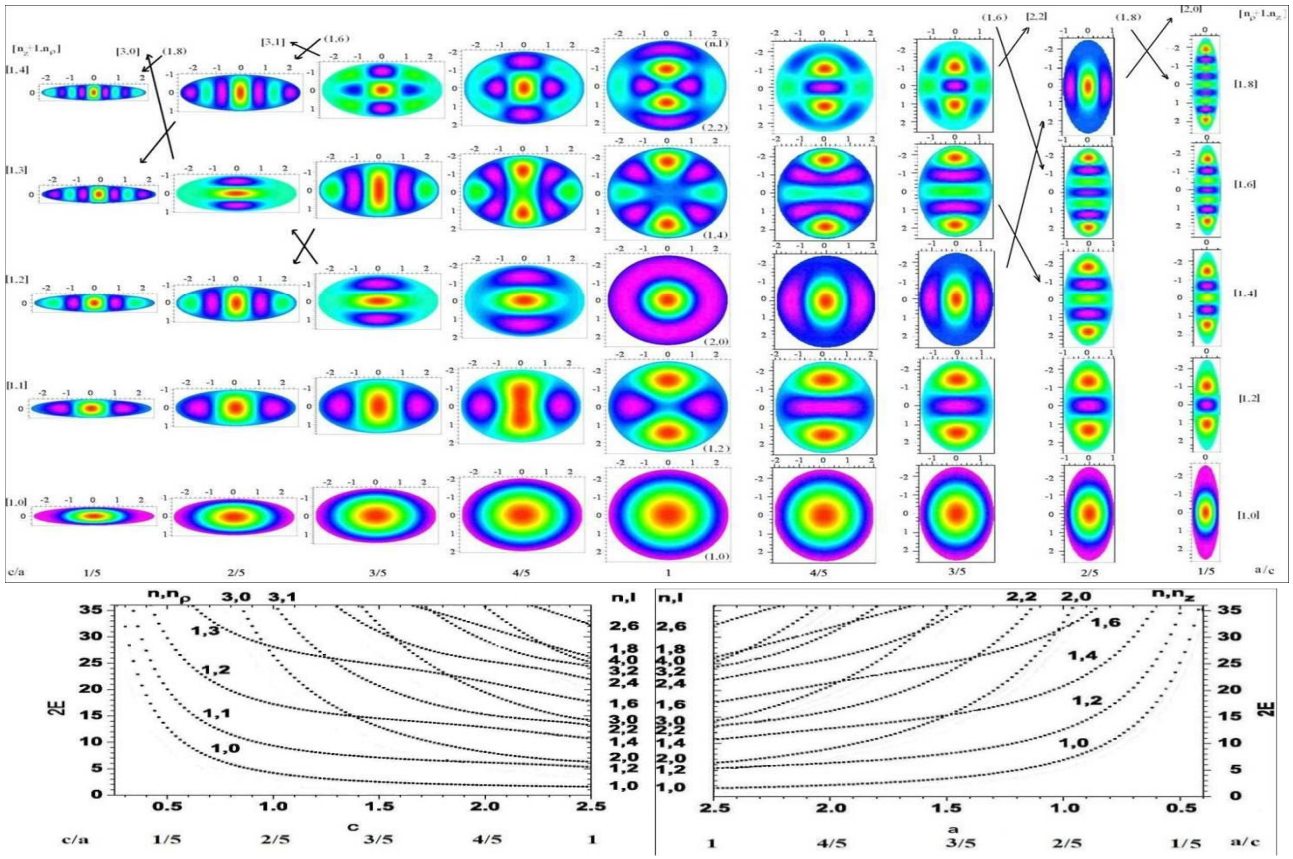


New grid site of [L.N. Gumilyov Eurasian National University] (Astana, Kazakhstan) has been set up and integrated into the JINR grid infrastructure.

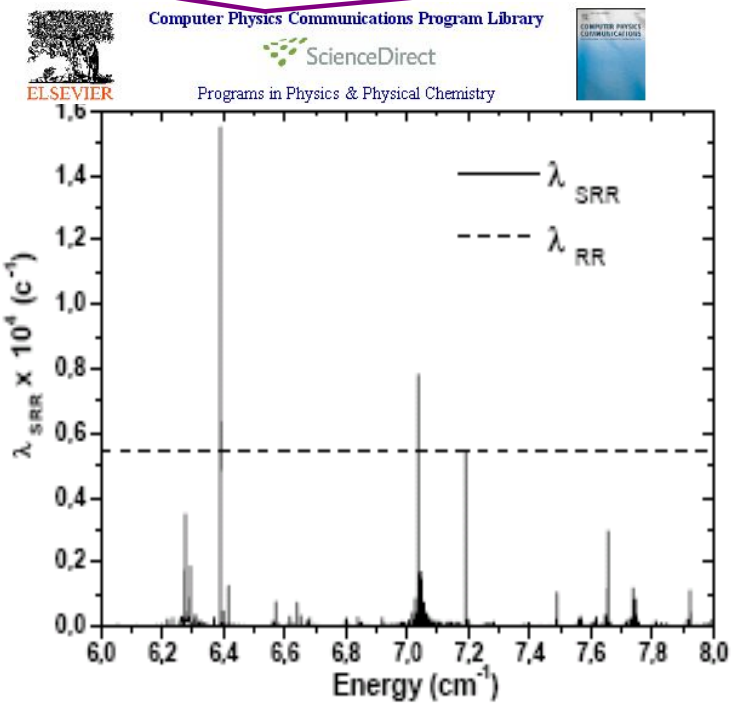
The first successful steps on development of Mongolian Grid-segment was done at the Institute of Computer Science MAS - an educational grid-site, which became a part of educational-scientific grid-infrastructure of the JINR Member States, was set-up in local test mode.

COMPUTER ANALYSIS OF MODEL NANO-STRUCTURES IN EXTERNAL FIELDS

Spectral, optical, and transport characteristics of quantum wells, quantum wires, and quantum dots of semiconductor nanostructures were investigated by means of computer simulation codes developed in LIT-JINR during 2008-2011. Symbolic-numerical algorithms and a problem-oriented complex of programs, are available via the Computer Physics Communication Program Library (downloaded from the CPC program library more than 600 times)



(Eigenenergies and eigenfunctions in terms of quantum dot shape)



(Laser-stimulated radiative recombination rate λ_{SRR} of positron and antiproton in a quantum wire)

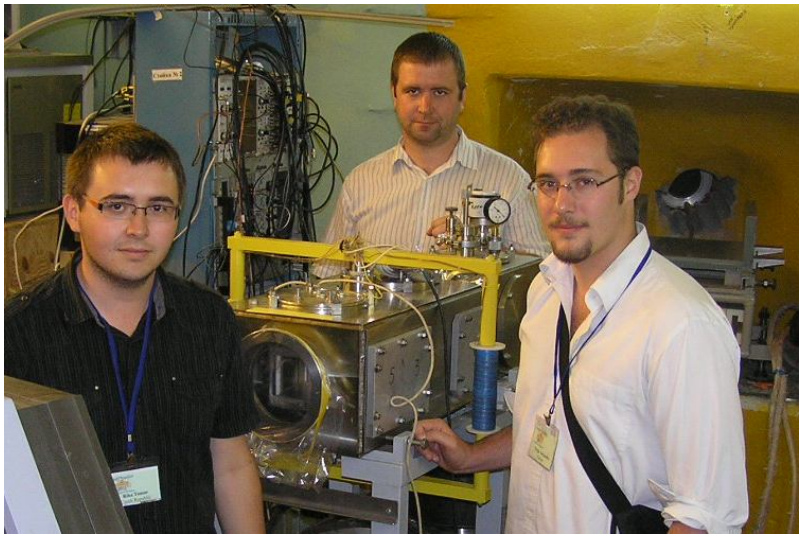
A.A. Gusev, O. Chuluunbaatar, V.P. Gerdt, V.A. Rostovtsev, (LIT), **S.I.Vinitsky** (BLTP), V.L. Derbov, V.V. Serov, (Saratov StU), P.M. Krassovitskiy (INP Almaty), H.A. Sarkisyan (Slavonic Univ. Yerevan)

Educational programs in 2011 at JINR

The International Summer Student Practice becomes very popular among Universities of the Member States. It is organized in three stages from May to September. In 2011, the total number of students from 10 JINR Member States taking part in the Practice was 140 (114 in 2010 and 88 in 2009).

The International Summer School "Nuclear Physics Methods and Accelerators in Biology and Medicine" was successfully organized in July.

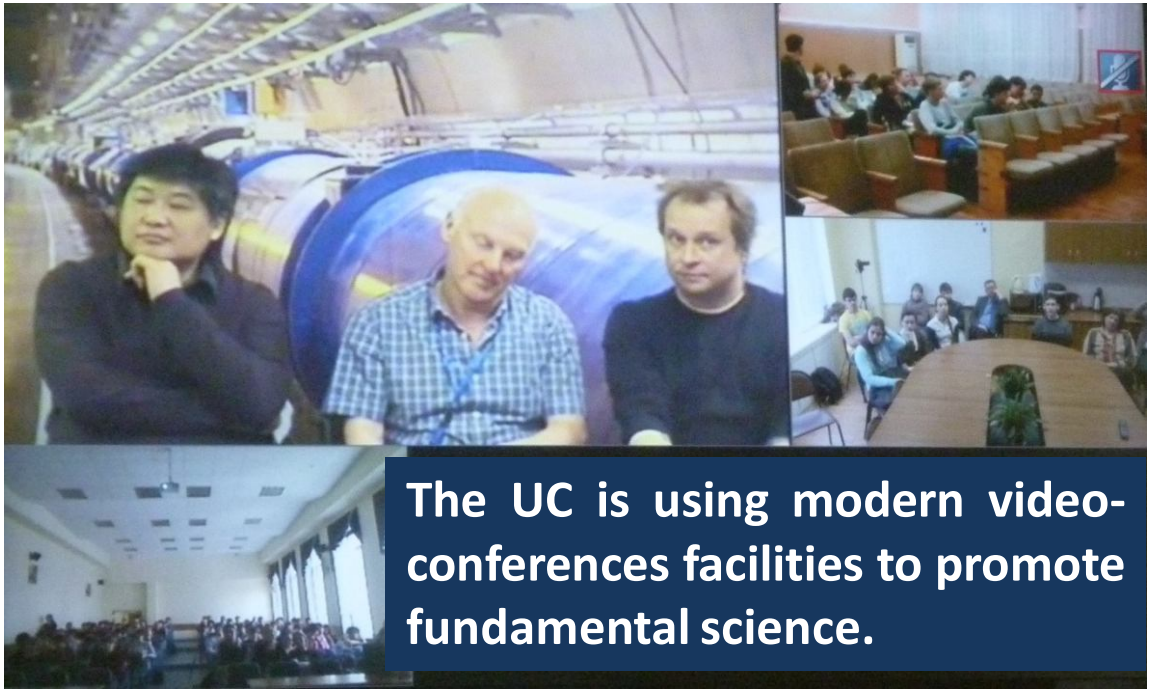
After celebrating its 20th anniversary on January 18, 2011 the JINR University Centre is facing the task of modernization of JINR educational programs to make them more attractive and effective. One of the problem is lack of modern training facilities and rather old hostel infrastructure used for the students arriving to JINR.



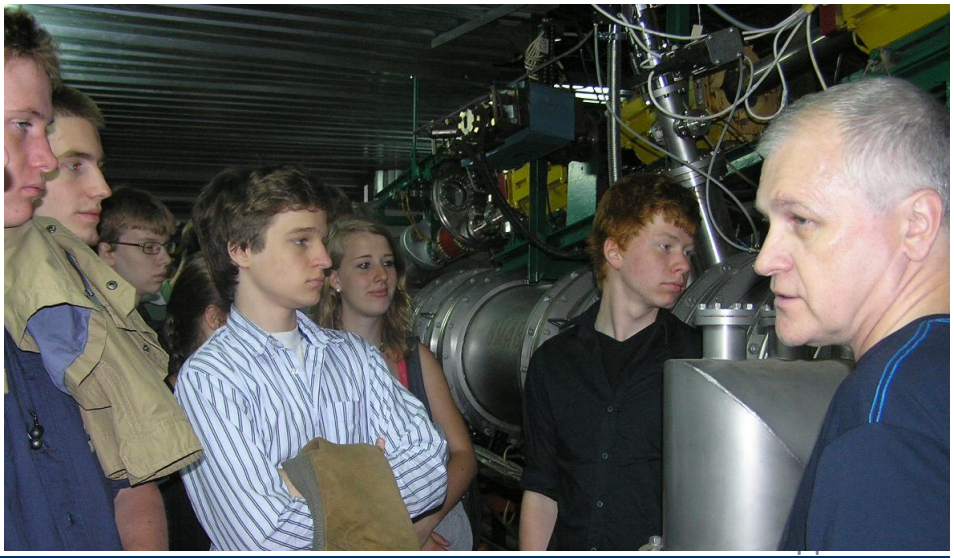
Propagation of fundamental science

The JINR University Centre is continuing its cooperation with CERN in organization of annual School Teacher Programs at CERN and JINR. Up to now, four Schools for teachers were organized: two at JINR in June 2010 and 2011 and two at CERN in November 2009 and 2010. During last School at JINR the Russian teachers had a possibility to come with their pupils.

The UC is organizing regularly acquaint visits of school delegations from the Member States.



The UC is using modern video-conferences facilities to promote fundamental science.



Latest Events and News in Brief

JINR - INFN

Dubna, 14 June. Signing of the JINR-INFN Agreement

The Italian delegation at the Veksler and Baldin Laboratory of High Energy Physics

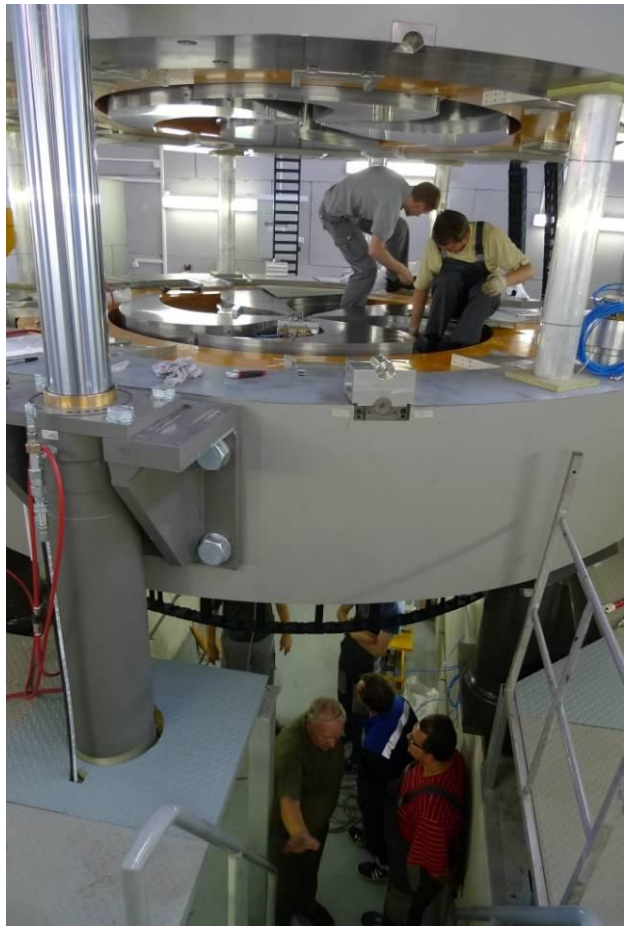
Italian scientists visit the memorial study of B.Pontecorvo in the Dzhelepov Laboratory of Nuclear Problems

German Ambassador U.Brandenburg Visits JINR

The Veksler and Balding Laboratory of High Energy Physics (from left to right):
Embassy official I.Suleimanov, VBLHEP Deputy Director E.-M.Ilgenfritz, Ambassador U.Brandenburg, Ch. Scheffzuek (DLNP), VBLHEP Director V.Kekelidze

Cargo from Antwerpen

2 June. Moscow canal, Zaprudnya



Unloading and installing the equipment
in Building 5, DLNP JINR.

Thank you!