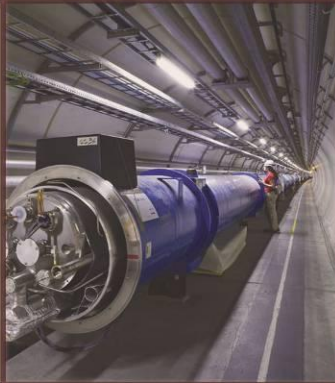
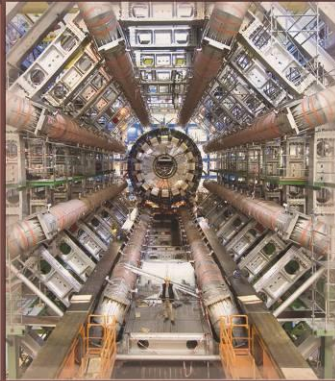


ALIKHANYAN NATIONAL LABORATORY

(ANL) 2011 status



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Alikhanyan National Laboratory (ANL) 2011 status

1. SUMMARY

ANL is a non-profit seeking, non-commercial legal State institution. The founder of the ANL is the Government Republic of Armenia (RA). Government of the Republic of Armenia nominates the Ministry of Economy for ANL governance. The funding body for ANL is State science committee under ministry of Science and high education. ANL owns developed technical and scientific infrastructure and significant property both land and buildings, see Table 1.

Table 1 ANLi premises in Yerevan and on slopes of Aragats mountain

#		Number of units	Building area (1000 m.sq.)	Total surface (hectare)
1	Industrial premises	69	65	34
2	Accelerator and experimental halls	18	26	
3	Office space		13	
4	Nor Amberd station	24	6.5	13
5	Aragats station	19	9.5	15
6	Holiday inns, cottadges, other	42	20	22
	Total	172	140	84

Technical Infrastructure

Power supply: only one 6 kV line from Davidashen high-voltage substation survives; the emergency cable is under repair. Power rating equals to 7.2 MW. Both lines are old and need to be changed; operation of the 6 GeV synchrotron in the present condition of the power supply is not possible. The Power supply of the cosmic ray stations is provided by matches carrying 35 kV aluminum wires. Five years ago the matches and wires were repaired. The emergency line to Aragats station is not operational; 60 matches were stolen. Water supply in Yerevan: many leakages in tubes; limited supply in daytime. Aragats and Nor Amberd: from springs and the lake; bio-active filters are needed. For almost 30 years there were no major repairs of the office rooms, toilets and technical infrastructures. Some of the Nor Amberd research stations rooms were repaired by means of the NFSAT grant (USA diaspora support) and several buildings were rescued from destruction at the Aragats research station by the INTAS infrastructure grant (jointly with DESY). The road to Aragats is in very bad shape, need urgent repair.

YerPhI car pool counts nearly 100 units. Most of them are 30-40 years old and not operational. Taxes and current car repairs are a huge burden to the institute budget; the cars should be written off as soon as possible.

Networking and computing

YerPhI was the first in Armenia who installed dedicated (satellite) line between DESY and YerPhI in 1994 for Internet connectivity through DESY, which became possible due to contribution of local “Hayastan” foundation, INTAS grant, and DESY, using technical support provided by MSU. Due to that 64 kbps line the Armenian .am domain was

registered in corresponding international organization and Internet took birth in Armenia. It is worth to mention that this line (increased to 256 kbps) remains exclusive up to 1998 when local telecom company "Armentel" installed another, more powerful, Internet connectivity. Since 1994 our Internet connectivity was shared with Armenian universities, Academy of Science and other scientific and educational organizations, regularly supported by DESY+NATO grants"

At 2000 we initiated a creation of a noncommercial foundation ARENA (Armenian Research Educational Networking Association) joining main universities and scientific institutes, which through Virtual Silk Highway NATO grant provides a satellite Internet connectivity (of total 6Mbps) to all main universities and institutes of Armenia. Now instead of Virtual Silk Highway YerPhI is connected by BSI (Black Sea Interconnection) FP7 grant to GEANT2 network of total 34 Mbps bandwidth reserved to Armenian scientific-educational organizations. The Aragats and Nor Amberd research stations are connected with servers in Yerevan by wireless radio-modems. The YerPhI computer center, as well as several research groups, is now ordering new servers; the computer resources of YerPhI and the planned connection to GRID will be enough for ongoing research projects, however a strategy to meet growing computation and networking demands is urgently needed. Under the financial support of DESY the PC farm with 2 servers (each by 2 processors) and 8 batch nodes has been purchased and installed, which allow Yerevan HERMES group perform the data analyzing tasks in Yerevan. In 2011 we receive from DESY 78 servers for establishing high productivity cluster for GRID and multivariate analysis purposes.

Education & training facilities

The YerPhI Space Education Center and CISCO networking Academia have lecture rooms and teaching laboratories on the territory of YerPhI campus. Near 100 students from Yerevan State University as well as from Yerevan based commercial organization and ministries took courses in these centers. New accommodation and classes rooms are prepared in the Nor Amberd International conferences center. Each year 3-4 conferences are hold in the center with number of participants up to 70.

2. BRIEF SUMMARY OF THE SCIENTIFIC ACTIVITIES

The Yerevan Physics Institute (YerPhI) was founded in 1943 as a branch of the Yerevan State University by brothers, Abraham Alikhanov and Artem Alikhanian. Later two high-altitude Cosmic Ray Stations were founded on Mount Aragats. Among the key results of YerPhI in the yearly years were the discovery of protons and neutrons in cosmic rays, and the establishment of the first evidence on existence of the particles with masses between that of muons and protons. The high altitude research stations have remained the main research base of the Cosmic Ray Division (CRD) of YerPhI until now. Among the CRD achievements were discovery of sharp knee in light components of primary cosmic rays, detection of the highest energy protons accelerated on the Sun, and the creation of the Aragats Space environmental Center in 2000 for studies of the solar-terrestrial connection where CRD become one of the world's leaders. The Synchrotron with 6 GeV energy of electrons was accomplished in 1967; the results obtained on meson photoproduction by unique beam of polarized gamma-quanta, investigations on transition radiation well-known among the scientific community. Traditional topic of YerPhI is the development of new particle detectors. Wide spark chambers and transition radiation detectors are examples of the experimental techniques developed and implemented in YerPhI. During the last years groups of scientists from Yerevan Physics Institute have actively participated in medium

and high energy physics experiments abroad (JLAB, DESY, CERN), exploring the meson and nucleon structures, electromagnetic interactions of the nucleon, quark-hadron duality, short range nucleon-nucleon correlations, quark hadronization in nuclear medium, quark-gluon plasma, and many other topics, as well as in construction of experimental hardware and development of the software for data acquisition and analysis. The theoretical department continues working in various fields, including QCD and Related Phenomenology, Standard Model Phenomenology, Neutrino physics, Cosmology, Quantum Field Theory, String/M-theory, Integrable Models, Statistical physics, Condensed Matter and Quantum Information. YerPhI groups actively participate in construction of the Atmospheric Cherenkov Telescopes at the Canarian islands and in Namibia.

After establishing the Alikhanyan National laboratory (ANL) on the bases of YerPhI according to recommendations of the international commission of the experts, hold according to decree of prime minister of Armenia in 2009, Armenian physicists continued work in fields of high energy physics and astrophysics in Armenia and world biggest facilities. Also new applied direction was added to ANL scientific program: nuclear medicine and low energy nuclear physics. Among latest achievements of ANL are:

LHC experiments

Since April 2010 LHC operates in a regime of protons collision with total energy $\sqrt{s} = 7.0$ TeV. YerPhI group actively participates in the CMS experimental physics program, mainly in the studies of the diffraction processes with Di-muon events. Recently the group has begun the analysis of the obtained experimental data. First results of the data analysis with Di-muon in SPE (Single Pomeron Exchange) process using information from CMS, CASTOR and ZDC detectors for an integrated luminosity of 36 pb^{-1} was obtained with participation of ANL group.

ATLAS experiment, has reported a dramatic effect that causes an unexpectedly large imbalance in the energy of jets of particles created in lead-ion collisions. This evidence may bring new insight to the primordial universe where a hot, dense medium of quarks and gluons may have prevailed.

This is the first observation of an enhancement of events with such large dijet asymmetries, not observed in proton-proton collisions, which may point to an interpretation in terms of strong jet energy loss in a hot, dense medium. YerPhI group significantly contributed in the construction, performance study and test beam analyses of the ATLAS Tile Hadron Calorimeter. Currently our physicists are participating in the jet analysis and in the calibration of the tools and overall performance of ATLAS.

DESY experiments (HERMES, H1, OLYMPUS):

The ANL groups continue the data analysis from the HERMES and H1 experiments. Among recent findings are precise measurements of spin structure functions g_1 and g_2 on proton and deuteron; measurements of exclusive reactions to get an access to the problem of orbital moment to solve the "spin crisis" problem, measurement of the generalized Gerasimov-Drell-Hearn SUM Rule; measurement of the single and double differential cross sections for inclusive jet, 2-jet and 3-jet as well as their multiplicities normalized to the neutral current DIS cross sections and many others. ANL group also actively participate in started Olympus experiment devoted to measure expected asymmetry in cross section of elastic scattering of electrons and positrons on hydrogen target. The Yerevan group performed the design, tests and commissioning of the TOF system of OLYMPUS spectrometer.

JLab experiments

ANL groups are actively contributing to JLab activities both for ongoing program to at 6 GeV in all three halls and preparation of future JLab12 experiments. Hall-A contributions include participation in Real Compton Scattering (RCS), preparation of BigCal for the formfactor measurements (GEP-III). ANL collaborators also participate in preparation of the experiment to study dark matter (APEX) and development of the Super Bigbite Spectrometer (SBS). ANL group in Hall B participates in running the 6 GeV experiments and in the calibration (eg6) and analysis of data (e1-6, eg2, e1f). With Stepan group is involved in the design, R&D and construction of six modules of pre-shower calorimeter for CLAS12. In the Hall-C ANL contributions include design and construction of the lead-glass calorimeter for Hall-C HMS and SOS spectrometers and Aerogel Cherenkov detector for HMS spectrometer.

Theory

Theoretical Physics Division of YerPhI was always considered as important center of modern theoretical physics in Armenia. The activities of the theoreticians cover a large area, the main direction of investigation being the theoretical high energy physics: phenomenology and quantum field theory. Also new interesting results were obtained in the fields of cosmology, Statistical Physics and Quantum Information, quantum computing, theory of biopolymers, neutrino oscillations, nucleon resonance studies, studies of spin-orbit correlation and many others.

Cosmic rays

CRD is now world leader in the surface monitoring of the secondary cosmic rays. Numerous particle detectors measuring charged and neutral fluxes are operating on 3 levels (800, 2000 and 3200 above sea level) and provide scientific community with unique data, assessable on-line from mirror sites in Europe and US. There is no research center in the world that measures so many different geophysical parameters, located at several high altitudes and providing on-line data worldwide. A huge advantage of ASEC is its consistency, 24 hours coverage, multi-year operation. Among recent achievements of CRD are discovery of highest energy protons (accelerated in the vicinity of the Sun; discovery of the terrestrial ground enhancements (TGEs) simultaneous fluxes of electrons, gamma rays and neutrons from the relativistic runaway electron avalanches in the thunderstorm atmospheres; founding of the world-wide network of new particle detectors for researches in space weather and solar physics, named SEVAN (Space Environment Viewing and Analysis Network). Nodes of the SEVAN network are now operating in Armenia, Bulgaria, Croatia and India.

International grants

Numerous research grants (to the total sum of about M10 USD) were allocated by to YerPhI by the international funding organization during Armenian independence years. The major sponsor till now is the International Science and Technology Center (ISTC). Current ISTC projects are mostly devoted to applied science and are about M3\$ in sum. Mean age of the participants of some of biggest projects (A1554, A1606) is significantly lower than YerPhI mean that is encouraging. Other funding organizations providing grants to YerPhI are: NATO Networking Infrastructure Grants, NATO Collaborative Linkage Grants, INTERNATIONAL ASSOCIATION for the promotion of co-operation with scientists from former Soviet Union (INTAS) Grants, Civilian Research and Development Fund (CRDF) grants, National Foundation of Science and Advanced Technologies (NFSAT) grants, European

office of aerospace research and development (EOARD) grants; Integrated Infrastructures Initiative project (I3) proposal Infrastructures Call 1, FP7- grants.

Awards (last 10 years):

3. World Summit Award (Geneva, 2003) for best content in e-science was delivered to Data Visualization Interactive Network (DVIN) for Aragats Space Environmental Center (ASEC), authors: A.Chilingarian, N.Gevorgyan, A.Yegikyan, G.Kostanyan, M. Ulikhanyan
4. The President of the Republic of Armenia Prize for Physics for 2005 was awarded to A.Akhperjanian and V.Sahakian as well as F.Aharonian (from MPIK, Heidelberg) for the works in the field of very high energy gamma-ray astrophysics including the researches done within the framework of the HEGRA and HESS collaborations.
5. The HESS collaboration including YerPhI has won the European Union Descartes Research Prize for 2006 as a world first in the field of gamma astronomy. The prize was awarded for "the revolution of existing astronomical observation techniques and increase of our knowledge and understanding of the Milky Way and beyond."
6. The First Scientific JINR Prize in 2006, authors: N. Akopov, S. Gerasimov, O. Teryaev, A. Nagajcev for "Studies of Q² dependence of generalized GDH integral."
7. The Second Scientific JINR Prize in 2007 – N. Akopov, I. Savin, A. Nagajcev "Studies of the spin structure function g₁"
8. Dr. S.G. Arutunian is winner of the 2008 Faraday Cup Award for the development, publication and successful testing of the diagnostic system "Vibrating Wire Scanner".

YerPhI employees are members of numerous international organizations, including:

American Physical Society (APS), American Geophysical Union (AGU), International Space Weather Initiative (ISWI), IEEE, International Commission for Space Research (COSPAR), COST actions (European cooperation in Science and Technology) and many others.

YerPhI scientists served on many international scientific boards. They were been chairpersons of many international conferences and given numerous presentations in the fields of high energy and cosmic ray physics and on new methods of data analysis.



Figure 1. Structure of YerPhI

National lab is among 100 world most-sited institutions in physics (Results are from website “ISI Web of Knowledge” of Thomson Reuters, see details on YerPhI publications in <http://yerphi.am>). In 2004-2010 there were more than 1000 publications authored and co-authored by the YerPhI employees in world-best scientific journals (see details in <http://yerphi.am>). More than 20% of all scientific publications in Armenia come from **YerPhI**.

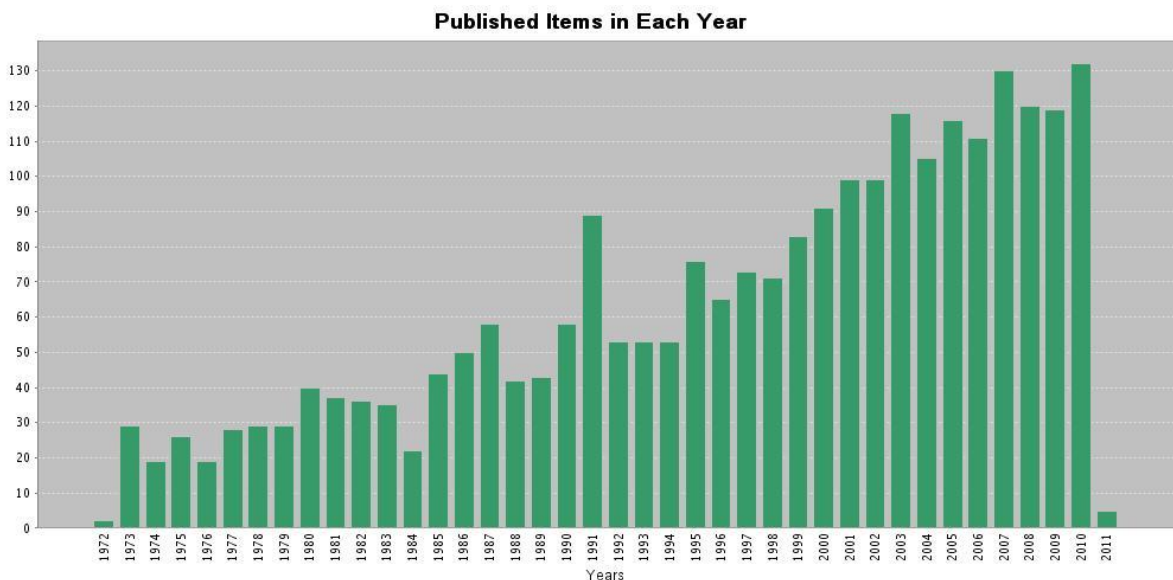


Figure 2. Distribution of the published papers in peer review journals

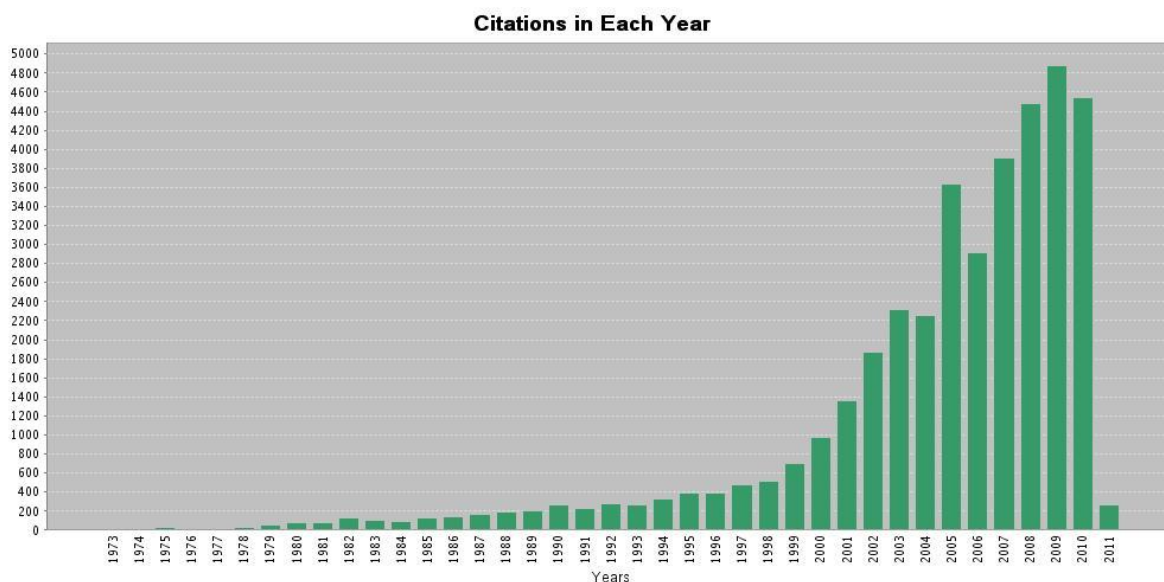


Figure 3. Number of citations of the national lab employee papers

3. NATIONAL LAB BUDGETARY ISSUES

National lab funding encompass 3 main sources: state funding (base and competitive projects), own profits, international grants and collaborators support, see Table 2. Before significant enhancement of the base funding in 2011, the international and state funding were approximately equivalent and own profits were ~ 15%. For 2011 state funding is approximately twice as international grants and own profits are expected to be enhanced due to several applied programs to be launched in 2011.

Table 2. National lab income from state, own profits and international grants

YERPHI INCOME	2011 (mln. drams) 1\$=373.4 dram (expected)	2010 (mln. drams) 1\$=373.4 dram	2009 (mln. drams) 1\$=377 dram
Base funding	665.5 M1.755	319,7 K856.2\$	283,2 K751\$
Project funding	43,50 K115\$	96,54 K258.5\$	92,8 K246\$
YerPhI Loans		24,266 K65	27,679 K73.6\$
NFSAT Grant, ArmRusGas		70,563.6 K189\$	17,007 K45.1\$
DESY (salary)		30,129.5 K80.7\$	31,402 K83.5\$
JLab (Internet)		3,871.0 K10.4	10,392 K27.6\$
INTAS, FP7,CRDF			34,436 K91.3\$
ISTC overhead			7,833 K20.8\$
Scientific conf.			3,783 K10.1\$
Applied radiation processing		4,232 K11.3\$	8,256 K22\$

Sales		4,239 K11.4\$	91,730
Other			25,761 = K6.8\$
Total from state (base +project)	798,5 M1,87	416,24 M1,15	376,0 \$1M
Own profits	141,9 K380\$	137,3 K368\$	143,3 K381\$
State + own	940,4 M2,250\$	553,54 M1,518\$	519,3 M1.381\$
ISTC	K816\$	1M\$	M1.1\$
State + own+ ISTC	M3,066\$	M2,518\$	M2,481\$

However, due to planned seas of ISTC operations in 2012 the income from international grants (despite new applications) expected to be decreased. Therefore, crucial reorganization of the national lab structure and scientific directions should be made in 2012 to survive the national lab goals and make a transition from survival only to development.

Table 3 National lab expenditures (without ISTC)

YERPHI EXPENDITURES	2011 1\$=373.4 DR	2010(MLN. DRAM) 1\$=373.4 DR	2009(MLN. DRAM) 1\$=377 DR
Salary	Mean should reach ~110,000 (mean in RA)	354,094.0 (62.9%)	356,928 (66.1%)
Electricity		34,389.4 (6.1%)	32,720.1 (6.06%)
Gas		3,665.4 (0.65%)	2,884.1 (0.53%) 60,950m³
Phone		2,443 (0.43%)	2,493.1 (0.46%)
Water		4,992.3 (0.89%)	5,874.0 (1.08%) 39.913m³
Internet		3,433 (0.61%)	3,999.2 (0.74%)
Taxes		22638 (4%)	21,002.0 (3.89%)
Business Travel High altitude st.		28284 (5%)	16,540.0 (3.06%)
Fuel		7763.3 (1.4%)	7,091.4 (1.31%)
Materials & equipment	To be ignificantly enlarged	26779 (4.8%)	38,536.1 (7.13%)
Other (repairs, etc...)	To be significantly enlarged	27483 (4.9%)	50,837 (9.42%)
Total		515,934 M1,382	539,784.6 M1,43\$

As we can see from the Table 3 the previous national lab budgets were survival ones with minimal salaries (much less comparing with state mean), without any significant purchase of materials and equipment, without any ammortisation of building and crucial technical infrastructure. Repairs were mostly made on high altitude stations Aragats and Nor Amberd by the international funds. Buidings in YerPhI campus are in misirable conditions (roof lickage, non regular water supply, old fashione lavatories, etc...). Materials and equipment for ongoing experiments in Armenia (mostly cosmic ray and nuclear physics on 50 MeV accelerator) were made by ISTC grants (see Table 4). Package of the ISTC grants include also applied projects that in 2011 expected to bring income to national lab. However, we can stand that for huge campus of national lab with many buildings and old technical infrastructure the expected funds are absolutely not enough and we urgently need realistic development program that will take into account the staff issue will be described in the next session.

Table 4. Annual (2010) income from ISTC projects

A-1554 Planetary Space Weather Research and Forecasting by Nnetwork of Particle Detectors	Chilingaryan Ashot	ISTC	2010	US\$ 210.385
A-1444 Development of Medicine Intended Isotopes Production Methods on the Basis of Accelerator Facility of Yerevan Physics Institute	Avetisyan Albert	ISTC	2010	US\$ 150.000
A-1602 Smith-Purcell Free Electron Laser	Hovhannisyan Koryun	ISTC	2010	US\$ 119.785
A-1606 Development of Armenian-Georgian Grid Infrastructure and applications in the Fields of High Energy Physics, Astrophysics and Quantum Physics	Mkoyan Sarkis	ISTC	2010	US\$ 53.930
A-1605 Development of Filtering systems on the basis of a super-thin Basalt fibers for the Nuclear Power Plants	Harutunyan Vachagan	ISTC	2010	US\$ 43.940
A-1754 Establishing of a Production line for production of laboratory furnaces	Harutyunyan Suren	ISTC	2010	US\$ 130.000
A-1786 Production of Medical Isotopes Using Electron Accelerator Facilities	Kerobyan Ivetta	ISTC	2010	US\$ 30.000

A-1661 Market research and business planning for technologies from the Institute of Physics	Grigoryan Gagik	ISTC	2010	US\$ 36.000
A-1766 Precision micro-processing using copper vapour lasers at Yerevan Physics Institute	Grigoryan Gagik	ISTC	2010	US\$ 42.000
TOTAL				US\$ 816.040

4. ANL STAFF

In Figure 4 one can see the distribution of the YerPhI employees by age. Age distribution is alarming on possible extinction of the high energy physics expertise in Armenia. Urgently measures are needed to knowledge transfer and recruiting students from Armenian universities.

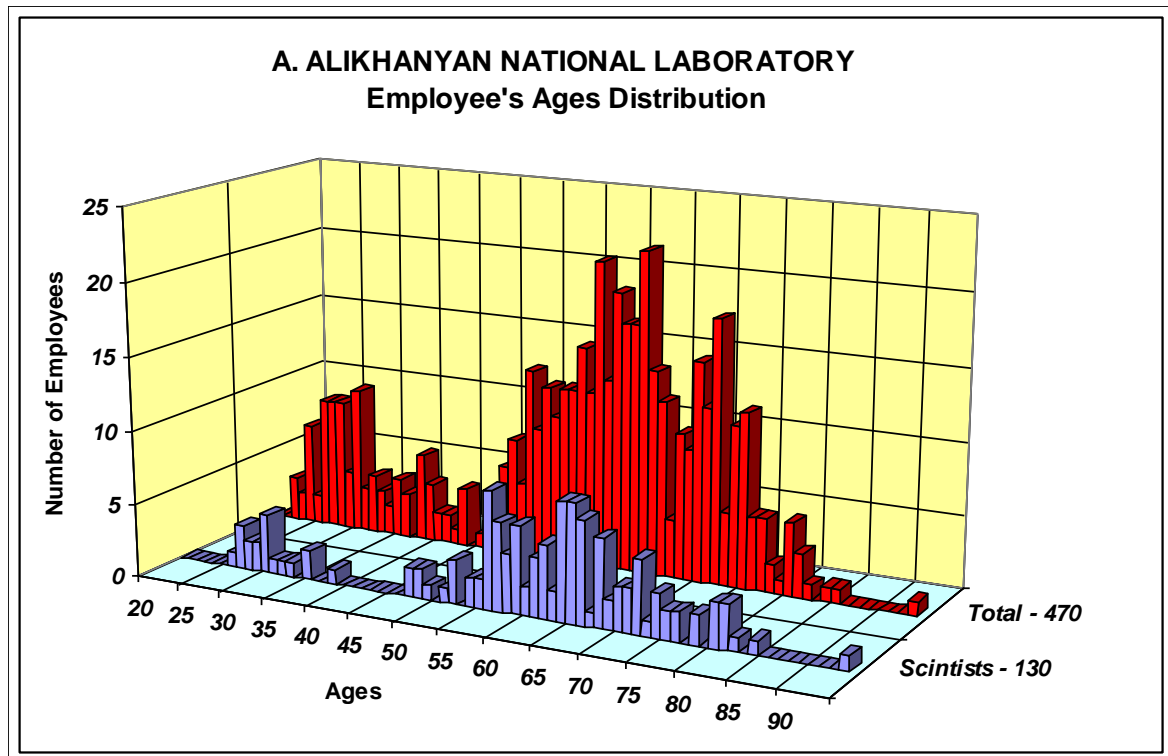


Figure 4. The ANL employees age distribution (all red, only PhDs – blue)

There is only 18 PhDs below 40 (mean age 30 year, half of them are theoreticians) and 112 PhDs above 40 (mean age 65). It signals that in 5 years ANL will be obliged inevitably to shrink from 500 employee institution to maximum ~100-150 employee institution. However, to make this transition maximally painless and survive the expertise and continuation of the projects where ANL had world competitiveness, the urgent measure should be undertaken without further delay. These measures should include significant increasing salaries of young scientists and PhD students, starting master and PhD programs in ANL, including young scientists in governing bodies of ANL. Also, we have to establish

support programs for elder scientists and pose the age limitations for positions of group leaders, members of elected councils, etc...

5. GOVERNMENTAL MEASURES TO RISQUÉ ANL

Despite continuing considerable successes and the decaying process of ANL started after collapse of Soviet Union reaches its culmination. From Figure 4 it is apparent that after few years huge experience in high energy physics will be completely lost. Armenian government recognizing this danger decides to invite external board formed from competent scientists to decide on main lines of institute development (see attachment 1). Institute prepared exhausting reports for commission and during session of commission in July 2009 the scenario of further development was worked out (see Attachment 2). The main recommendation was to develop Nuclear Physics research with new accelerators for both fundamental research and applied problems. Experiments in high energy physics was recommended to perform on accelerators abroad, Cosmic ray physics and high energy astrophysics at Aragats. Armenian government was consistent and 2 governmental decisions on creation of nuclear medicine center on premises of YerPhI (Attachment 3) and on organization of National lab (draft, see Attachment 4 and 5).

To preserve YerPhI as center of excellence for high energy, nuclear and cosmic ray physics, as well as for promoting applied research, important for Armenian economy national center will perform fundamental science research as well as innovation program:

Fundamental science

- 1. High energy experimental physics: participation in the CERN, DESY and Jefferson Lab (USA) experiments.**
- 2. Theoretical physics.**
- 3. High energy astrophysics.**
- 4. Earth-Sun connections, Solar physics, Space weather.**
- 5. Accelerator physics.**
- 6. Nuclear physics.**

Innovation programs

1. Applied nuclear physics:

- Isotope production;
- High energy ion fluxes production for medical purposes;
- Satellite electronics testing with ion beams;
- Filter (membrane) production;
- Radiation processing.

2. Applied Cosmic Ray Physics:

- Cosmic ray and geomagnetic storms forecasting, development of a forecasting portal;
- Researches on weather changes connecting with cosmic ray fluxes;
- Lightning and hail cloud monitoring.

3. Energy saving technologies:

- Production of solar water heaters;
- Installation of solar electrostations in Yerevan and high altitude stations.

4. **Lazer technologies.**
5. **Scientific instrumentation:**
 - Elementary particle detectors;
 - X-ray and gamma scanners.
6. **High productivity computing technologies:**
 - IBM-cell computing
 - GRID computing
7. **Management of the intellectual property (IP):**
 - identification and classification of IP;
 - performance rating of the IP developed in YerPhI;
 - determination of the owners of the property;
 - definition of the policy in management of the intellectual property.
8. **Education center:**
 - Integration of Research and Education;
 - start master courses in beam technologies, nuclear and cosmic ray physics, particle detectors;
 - establish training and conference centers in Yerevan and Nor-Amberd;
 - equip education centers with modern equipment.
9. **Make a base of experts for the consulting services** for the Armenian manufacturers and entrepreneurs

The decision on purchasing of IBA 18/18 proton cyclotron was made, funds allocated, the place in the ANL campus decided (see attachment 7) and the tender of project declared.

6. CONCLUSION

The first meeting of the new established Scientific Advisory board (SAB, see attachment 6) is planned on April 12-16, 2011. ANL scientists are actively preparing projects for submitting to SAB: here is the preliminary list, to be enlarged significantly (dead line on March 25).

Theoretical Physics

1. **Nerses Ananikyan.** Classical and Quantum Phase Transitions on Lattices
2. **Hrachia Asatrian.** The B-mesons' Inclusive Rare Decays and Oscillations.
3. **Vahagn Gurzadyan.** Dynamical systems in cosmology: theory vs. modeling and data analysis
4. **Karo Ispiryan.** New interactions of high energy ions in crystals and the production of X-ray radiation by microbunched beams.
5. **Davit Sahakyan.** Statistical physics of disordered systems and its interdisciplinary applications.
6. **Ara Sedrakyan.** Investigations in low dimensional physics($d=1,2,3,4$): Applications to non-critical strings and condensed matter physics
7. **Sayatnova Tamaryan.** Quantum Computation and Communication Technology
8. **Inna Aznauryan.** QCD and Spin Effects in Hadronic and Nuclear Interactions

Cosmic Physics

- 9. Ashot Chilingaryan.** Investigation of the energetic processes in the solar corona, heliosphere, atmosphere, ionosphere and magnetosphere at the Aragats space-environmental center (Solar modulation effects and Thunderstorm Ground Enhancements in fluxes of cosmic rays detected at mountain altitudes)
- 10. Romen Martirosov** Study of Very-high Energy Cosmic Rays and Gamma Rays
- 11. Valery Pogosov.** The low background measurements
- 12. Hovsepyan Gagik,** Development of the test facility for the geophysical screening with high energy cosmic ray muons

Experiments on accelerators

- 13. Hamlet Mkrtychyan.** Study of the structure of hadrons, their production and electromagnetic interaction properties with high energy electrons and photons.
- 14. Norayr Akopov.** Studies of hadron physics based on the data accumulated at HERMES experiment
- 15. Gulkanyan Hrant** The study of the particle production mechanisms in high energy nuclear interactions

Applied Physics

- 16. Vachagan Harurtyunyan.** In-Situ Study of Phenomena Induced by Electron and Ultraviolet Irradiations in High Temperature Superconductors, Semiconductor and laser Crystals

We expect from SAB recommendations on presented projects and and long term strategy of ANL.

Attachment 1.
RA prime minister decrees

**RA government
DECREE**

“May 20, 2009, 416-U”

**On the creation of independent International Commission of Experts
(InComEx)**

In compliance with the RA president July 18, 2007 ՆՀ-174-Ն decree, sub-paragraph 2 of paragraph 1, and for the conduction of independent expertize to establish the perspective development directions of the “A.I.Alikhanian Yerevan Physics Institute” non-commercial state organization, to realize its administration improvements, to increase its scientific research productivity:

1. Create an International Commission of Experts in accordance with the Annex.
2. The RA prime minister to submit to the RA government a report on the development strategies of the “A. I. Alikhanian National Science Laboratory” non-commercial state organization development directions, based on the conclusion of the Commission of Experts.

Tigran Sargsyan

Attachment 2.
Conclusions and Recommendations of the InComEx

The work of InComEx

The International Commission of Experts (InComEx) met in Yerevan, Armenia, from July 22-25, 2009. InComEx heard reports, presentations, and future plans from all divisions of the Yerevan Physics Institute. An agenda of the presentations is attached. InComEx discussions revolved around the five major areas:

1. The Yerevan Physics Institute as a whole
2. Scientific research in the field of experimental physics on accelerators
3. Cosmic rays investigations
4. Accelerator facilities and accelerator physics
5. Theoretical physics research

A general discussion and two closed sessions of InComEx on questions, connected with the present-day status and future development of YerPhI, were held.

The members of InComEx visited the accelerator complex of YerPhI and the Cosmic ray stations on Mount Aragats.

On the request of the Chairman of InComEx, its members on July 23 met with the President of the National Academy of Sciences of Armenia acad. R.M. Martirosyan and academician-secretary of the Physics Division of NAS acad. Yu.S. Chilingaryan.

Another meeting on July 25 was organized with the Minister of Economy of Armenia Dr. N. Yeritsyan, under whose supervision is at present YerPhI.

Main conclusions

From the analysis of the presented reports and from the discussions, InComEx got detailed enough information concerning the present activity in fundamental and applied research, as well as the status of YerPhI and its role in the development of science, education and innovation technologies in Armenia. These conclusions are of strategic nature and we do not attempt to comment on each individual programme.

InComEx can thus point to the Current status of YerPhI as follows:

1. The Institute has undergone a difficult period following the collapse of USSR
2. But managed to recover to some extent by seeking external collaborations and funding

THUS:

1. It is a Centre of excellence for physics in Armenia - YerPhI is the unique Armenian Institution in its areas
2. It has research infrastructures that are unique in Armenia (in the region): accelerator facility, detector capability, scientific expertise
3. The Cosmic Ray Division at YerPhI owns two unique, extended facilities at nearby Mt Aragats at 2000 m and 3250 m altitude, offering sites for experimental activities with relevant instrumentation and analysis techniques
4. High scientific productivity - most Armenian papers/citations in SPIRES database show that YerPhI is leading in the region in the field of physic .

HOWEVER:

3. Dispersed effort is obvious
4. Research in nuclear physics is poor
5. The age structure is bad
6. The governance structure is confused and complicated
7. The funding from the Government is inadequate for working in the field of experimental physics.

Once again InComEx underlines the fact that with its 66-year history, active scientific activities in different fields of modern physics, with the search for fields of applying the achievements of physics in interdisciplinary sciences and technologies, YerPhI with its infrastructure offers *a unique basis for further development of science and science intensive technologies in Armenia.*

The participation of the physicists of YerPhI in large scientific projects, in investigations carried out by large collaborations at the accelerator complexes in Europe

and in the USA, the designing and manufacturing of modern experimental facilities are the direct and most efficient way to transfer the achievements of world leading science and of advanced technologies in many projects of national scale. Such connections should be realized via YerPhI, which is located in the capital of the country and is closely connected with its scientific, educational and technical structure.

For this reason, there is no doubt that the functioning and the development of this center should be continued.

However, because of the long, almost 18-year decline of activities in the field of experimental physics, YerPhI in its present-day condition is not able to perform this mission in full scale. There are questions connected to:

- The main experimental base of the Institute and its infrastructure are very old, while the strongly limited funding does not allow overcoming this lag;
- There is no clear concept of development of the Institute; the perspectives of its development and the priorities are not clearly determined;
- There is no inflow of young specialists – the question stands: How to recruit and retain them? There is a gap in the age distribution; so – some should be attracted back from the Diaspora!
- Is the staffing level appropriate? (At the moment the staff is retained beyond normal retirement age because of social reasons – is it possible to find an alternative to employment by YerPhI?)

InComEx accepts the following *Vision for YerPhI* as appropriate and proposes it to the Armenian authorities for consideration:

- YerPhI should be transformed into a National Laboratory of Armenia (NLA)
- NLA should primarily ensure scientific excellence at an international level
- NLA's role: to develop and maintain research infrastructures for fundamental physics (particle, nuclear, astroparticle), accelerator science and their applications
- NLA's role: as node that connects Armenia to the international physics community - enabling participation in world leading projects
- NLA should be a channel for bringing new developments to Armenia – e.g., nuclear medicine, GRID with the National Academy of Sciences, and opportunities for developing a technology base for Armenia, etc...
- NLA should be a node for training students in fundamental physics, related technologies, informatics
- NLA's activities would be essential for the knowledge economy of Armenia.

Starting from all the-above-mentioned, InComEx has drawn up recommendations, which are given below by specific area along with recommendations on the structure of NLA:

GENERAL RECOMMENDATIONS

Particle Physics

A. Particle Physics abroad

Front-line particle physics research in every country around the globe requires access to international facilities and participation in experiments there.

Therefore in the future, it is necessary:

1. To continue to put strong emphasis on international collaborations at facilities abroad such as at TJNAF (USA), DESY (Germany), CERN (Switzerland), JINR (Dubna), HESS (Namibia), etc.
 - In doing so, follow successful models of collaboration such as developed e.g. for the HERMES experiment (persons rotating between experiment and YerPhI, combined with strong analysis effort at the Institute);
 - Focus efforts to obtain greater visibility and impact (choice to be made by YerPhI and depends on people, involvement of students and local conditions).
2. Now is the time to ramp up LHC physics analysis and involve students, since in the near future, experiments at the CERN LHC will be key to the future of particle physics.
3. Government support of the teams is essential.

B. Particle Physics at home

Since in-house particle experiments with ARUS are considered by InComEx as not competitive at international level, it is recommended:

4. To develop and focus the scientific and technical base of YerPhI further in order to make the participation in the above-mentioned collaborative experiments more effective (e.g., detector construction, data analysis, etc.).
5. To create at YerPhI a center with high-speed communication lines and develops a GRID infrastructure (in collaboration with the Academy) for the purpose of proceeding experimental data and their theoretical analysis. A YerPhI center can be engaged in significantly wider activities in the information space and can introduce into Armenia high productivity computing and modern systems of communication. Such a center will be also useful for other sciences and e-health.

Cosmic Rays

The Cosmic Ray Department at YerPhI has a strong track record in Astroparticle Physics with expertise in cosmic ray physics, gamma ray astronomy and space weather research, including the relevant instrumentation and analysis techniques.

InComEx finds the following:

1. Recently a new activity has been initiated in the Cosmic Ray Division in the field of Solar and Space weather studies. Given the importance of expected results from the new "Space Environment Viewing and Analysis Network" (SEVAN) for studies of Solar and Geomagnetic effects, together with the facilities of the Aragats Space

Environmental Center (ASEC), there exist certain prospects for YerPhI, provided that the group will focus its activity on the acquisition and exploitation of the neutron and particle monitors and transmission of data to the network centers, and will reorient its members towards professional studies in a new research area.

2. Membership in the HESS (and the upcoming HESS-2) collaboration in Namibia and the next-generation Observatory CTA offer very good opportunities for the institute: cosmic ray and air shower physics has scientific potential for the next 15 years. Whether this activity can be developed further at a modern international level is a key issue, and requires significant increase of the financial support. Scope for industrial involvement and hardware activities at YerPhI in the construction of the future instruments.
3. The GAMMA experiment can be continued. But we recommend extensive studies and separate consideration concerning the perspectives of this research area on Mt. Aragats in the institute with participation of international experts.
4. Because of the unique opportunities given by Mount Aragats (large infrastructure, accessible high mountain close to Yerevan, sites at different altitudes), the scope in light of likely future scientific needs should be re-assessed. It is advisable to encourage other (scientific) users of the facilities.

Nuclear Physics

Nuclear Physics at YerPhI is not at an internationally competitive level although collaboration with JINR (Dubna) and LUND exists and the scientists of YerPhI in some experiments at TJNAF (USA) play leadership roles. On the other hand, ***Nuclear Physics is important for the future of Armenia for its crucial dependence on nuclear energy and new economic/scientific bases of nuclear medicine, environmental and radiation monitoring.***

We recommend the following:

1. Although the proposed experiments on the basis of the electron linear accelerator with an energy range $E = 15-75$ MeV are not competitive internationally, they are at present the only basis for the education and training of students in nuclear physics in Yerevan. This might also have implications to training of experts in Armenia for radiological and environmental monitoring.
2. One exciting option for a bright scientific / technological / economic future of Armenia would be the creation of a dedicated facility (cyclotron for protons and heavy ions) to be used for investigations in fundamental nuclear physics – investigations of e.g., neutron-rich isotopes, nuclear structure, nuclear reactions.
3. At the R&D stage of such a project, and after putting it into operation, Armenia could simultaneously develop skills in applications of nuclear physics' methods in interdisciplinary fields of science and technology, for example, hadron therapy and research in nuclear medicine.
4. Collaboration with international laboratories is necessary (e.g., JINR-Dubna, GSI, GANIL, RIKEN, FRIB@MSU, ...). Funding is necessary for groups in Yerevan from the government to participate in these collaborations. That way, Armenia can also take part in construction projects and bring some revenue to the laboratory.
5. Sufficient support from the government is absolutely necessary.

Accelerator Physics

YerPhI has made, and continues to make, important contributions to accelerators abroad. We propose:

1. To work out a conceptual project for the development of a strong group in accelerator science by the creation/construction/purchase of an accelerator for ions with mass number $A = 10-150$ and energies up to $10-20$ MeV/nucleon, with the aim of simultaneously performing research in basic and applied sciences. The choice for the type and parameters of such an accelerator should be determined by the scientific staff of NLA as a focused and concrete research programme is developed along with a plan by the ministry for securing the financial resources necessary for such a project.
2. To keep up the know-how in accelerator physics, which is of strategic value for a country like Armenia, as there are perspectives for applications to medicine, industry, etc. Training of students on some facilities at home is crucial for the future of securing a skilled workforce in Armenia.
3. YerPhI should participate actively in international accelerator collaborations with industry as well as scientific laboratories.
4. In perspective, to consider the possibility of creating, on the basis of the existing infrastructure of the accelerator (the synchrotron), of heavy ion beams with an energy up to $1\text{ GeV}/n$ with the aim to perform:
 - a) Investigations in the field of hadron physics with beams of stable and radioactive nuclei.
 - b) Radiotherapy of vitally important parts of the human body and large-scale radiobiological investigations.
 - c) Investigations of radiation damage effects of electronic components for long-term use (in cosmic flights) and the creation of precise micro- and nano-structures in new materials, etc.

Theoretical Physics

Although strong research in certain areas, including QCD and more formal field theory, as well as a large number of citations, has been registered, we find that:

1. In the activity of the theoretical department it is desirable to single out as of highest priority those physical investigations in which the Institute carries out and intends to perform in the future experimental research.
2. Encourage interaction with LHC and astro-particle experimental programmes. Also – support a plan to set up regular theory-experiment seminar on LHC physics.
3. Activity in nuclear theory is highly desirable, given the importance of experimental nuclear physics to the future of Armenia.
 4. The participation of researchers from the Institute in the development of the computer infrastructure of YerPhI should be defined.
 5. The proposed educational programmes for graduate students and young researchers should be enlarged and run both for theorists and experimentalists (see the “experimental programme”).

Educational and recruiting of young scientists programme

The most valuable resource in any country is its people, particularly those trained with the skills and education to enhance the economic standing of a country. It is therefore absolutely necessary to undertake cardinal measures for the yearly employment of the staff at YerPhI, on permanent positions, the education/employment of students, and those who have graduated from institutes of higher education in Armenia and young specialists.

For this purpose, we propose:

1. YerPhI together with the Ministry of science and education to draw up a programme for the training and work of students / young physicists and engineers in YerPhI. For this purpose to foresee separate financing of salaries.
2. It is advisable to increase the number of Armenian graduate students continuing with PhD studies. It is advisable to provide in YerPhI conditions for the performance of original research and for participation in collaborations at large-scale facilities.

A plan for recruiting young people should be drawn (open new positions for young people and define their status). Efforts should be applied, as it has been done in other countries, by attracting back from abroad their very brightest people and providing them with the conditions in which they can succeed.

Applied research

In every country around the globe, economic success is built around the applications of basic research. We therefore propose:

1. To develop a programme in ***applied research*** (a separate division, department, or center) in parallel with the research activities at YerPhI in the fields of fundamental physics.
2. For this purpose, it might be advisable to invite an ***International group of competent and independent experts***.
3. Introduce a contract-based system for investing and financing of activities in the field of applied physics with the involvement of resources from international funding agencies, international laboratories, Armenian govt. resources, and private investors (national and international). As far as possible, to attract (on the basis of contracts) for the accomplishment of applied physics problems the researchers and engineers from the scientific departments of the Institute.

Status and structure of YerPhI

1. The aim of YerPhI is to carry out both scientific research in order to obtain new information on the structure and the fundamental properties of matter and applied research by means of nuclear methods and technologies.
2. The main directions of activities of the Institute are:
 - physics of elementary particles and cosmic rays,
 - nuclear physics and nuclear reactions,
 - space weather and atmospheric phenomena,
 - accelerator physics and techniques,
 - information technologies and automation of scientific research,

- use of nuclear physics techniques in interdisciplinary sciences and also for applications, such as medicine and others,
 - investigations in the field of biophysics and genetics.
3. In connection with the multi-plan scientific work of YerPhI in and outside Armenia, as well as with the development of activities in applied directions, it is preferable to give to the Institute the status of a *National Laboratory of Armenia (NLA)* (according to the American classification: National Laboratory), or National Center for Nuclear Physics by changing its staff structure and funding system.

Funding

1. The Government of Armenia might consider the possibility of funding the Institute (the National Laboratory) from two sources:
 - fundamental research: from the federal budget (science and education) to the extent necessary for fulfilling the scientific topical plans,
 - applied research and developments: from sources (economy and innovations) on the basis of contracts, with the possibility to involve private capital.
2. YerPhI should continue to explore external funding sources – e.g., EU, ISTC, etc.
3. Need to budget adequate funding for participation in international collaborations: e.g., LHC, HESS, Auger, etc.
4. Adequate salaries for staff members should be ensured.
5. To increase during the coming two years the budgetary part of funding YerPhI. To use the system of priority funding of activities connected with the renovation of the experimental base of the Institute, including the experimental base for investigations in nuclear physics, its infrastructure and the implementation of top-priority experiments of the scientific topical plan.
6. To ensure funding for increasing the number of grants, additionally coming to YerPhI from external organizations. To ensure that there are positions for young students to enter Ph.D. level studies at NLA.
7. To determine the priority fields and investment programme of applied activities performed directly in the Institute or with the participation of researchers from YerPhI in other programmes. To work out a funding system so as to carry out applied research and be able to implement them taking into account the possibility of employing the Institute staff, of using its equipment, infrastructure, etc.

SPECIFIC RECOMMENDATIONS

RECOMMENDATIONS FOR GOVERNANCE

There is large uncertainty in the governance of YerPhI now. Uncertainties in budgets, in scientific planning, and the number of student positions does not allow for planning particularly since they come from varied sources. *Therefore, it is recommended to have clear and transparent governance where the director of YerPhI presents annually the plans of YerPhI and receives the budget. The plans of YerPhI have to be focused and ready to implement. In order to ensure that the scientific programme is world leading and competitive, it is recommended to establish a standing international advisory committee to advise the director and to evaluate the scientific programme of the Laboratory before it is presented to the ministry for funding.*

Thus, it is recommended:

- To improve the governance. To bring it in accordance with the scientific plans and the structure of a National Laboratory,
- To have transparent and unified governmental responsibility,
- To create a Standing International Advisory Committee IAC (with some members from Armenia).

SCIENTIFIC RECOMMENDATIONS

- Focus scientific efforts at YerPhI, define priorities,
- Government to support priorities proposed by director and scientists of YerPhi and IAC,
- Not to be afraid to close old facilities in order to make the construction of new facilities possible,
- Strengthen nuclear physics,
- Create and exploit a centre for accelerator science in Armenia.

Acknowledgements

The members of InComEx expresses thanks to:

- Minister N. Yeritsyan for his personal involvement and substantial discussions
- Director A. Chilingaryan and department leaders for their efforts
- The staff of YerPhI for their energetic and open participation in the discussions

The members of InComEx were impressed by the enthusiasm and engagement of all people involved in the work of the Commission.

On behalf of
InComEx

acad. Yury Oganessian
Chairman
Dubna, September 14, 2009.

Attachment 3.

Ra Government Decision

N - N

To Contribute to the Development of Oncological and Nuclear Medicine Spheres in RA, Approve the Establishment of Radionuclide Production Complex In “A.I. Alikhanian Yerevan Physics Institute” – State Non-Commercial Organization and Recognize the RA February 19, 2009 N 310decision Invalid

Considering that within the RA health maintenance and improvement activities there exist a necessity to develop the oncologic and nuclear medicine spheres and to render medical services based on modern medical methods and technologies, as well as to spur the investments in this sphere and make RA a center of oncological and nuclear medicine center the RA government decides:

1. To approve the implementation of nuclear medicine technologies and apply them when rendering medical aid: radionuclide researches, diagnostics, and treatment, post-treatment recovery, special attention should be paid to the professional potential of the medical personnel, their skill enhancement and development of medical institutions capabilities;

2. to realize the development of the oncologic and nuclear medicine spheres, including establishment of radionuclide production complex, implementation of radionuclide- based medical facilities and technologies in medical institutions and apply them in rendering modern, high quality diagnostic and medical services in oncology;

3. to approve the establishment of radionuclide production complex on the base of the “A.I. Alikhanian Yerevan Physics Institute”- a state non-commercial organization (henceforth organization). To state as objective of the complex exploitation the implementation of educational and research activities in physics and in medical aid sphere- radionuclide and ion beams production through the application of nuclear medicine, used for the diagnostics and medical service rendering.

4. Ensure that:

1) The oncologic and nuclear medicine spheres are the main directions of health improvement;

2) the main funding sources for diagnostics, treatment and post-treatment recovery and nuclear medicine complex development, as well as rendered services are the RA state budget, the sums received from the provided services, the medical insurance system , internal and external loan and investment programs, grants and endowments.

5. provide that the RA national competitive fund realize in RA the systemization and support of nuclear medicine development and the process of oncology promotion center creation: cyclotron purchase, transportation, implementation and actuation, as well aid to the execution of the corresponding campus constructional works; management and enrollment of the acquired professional personnel;

6. a loan guarantee for 8 000 000.00 euro equal drams for the purchase, transportation, implementation and actuation of cyclotron is provided

7. the RA government provide a 4000 000.00 euro equal drams loan with admmissive conditions for the constructional works as well as cyclotron actuation and exploitation expenses for governmental elements, necessary for cyclotron implementation

8. If the balance of incomes and expenses from cyclotron- based rendered services is negative, the RA should compensate the difference from the state budget, in the volume established by the RA government.

9. the RA minister of Economy provide corresponding conditions for the implementation of radionuclide production complex in the organization;

10. the RA minister of Finances provide the allocation of funds necessary for the development of nuclear medicine in RA in the amount defined by this decision and the RA government;

11. the RA minister of Health develop and implement the medical aid standards and procedures in oncologic sphere, including the nuclear medicine- based research , diagnostics and treatment efficient elements;

12. provide that the RA government February 19, 2009 N 310-N decision on the implementation “Cyclotron-30” isotope production complex in “A.I. Alikhanian Yerevan Physics Institute” state non-commercial organization and approval of nuclear medicine center creation support program in RA is recognized invalid.

13. This decision is valid the next day after its formal publication

RA
Prime Minister

Tigran Sargsyan

Attachment 4.

Ra Government Decision

N – N

To Rename “The A.I. Alikhanian Yerevan Physics Institute”- A State Non-Commercial Organization Into “A.A. Alikhanian National Scientific Laboratory” - a State Non-Commercial Organization, to Establish its Activity Sphere and to Recognize the RA Government February 2, 2002 Decision Invalid

To establish the perspective development directions of the “A.I.Alikhanian Yerevan Physics Institute”-a state non-commercial organization, to realize its administration improvements, and to increase its scientific research productivity the RA government *decides:*

- 1) To rename the “A.I.Alikhanian Yerevan Physics Institute”-a state non-commercial organization under the RA Ministry of Economy, into “A.I. Alikhanian State Scientific Laboratory”- a state non-commercial organization (henceforth organization).
- 2) Establish that:
 1. The main objective of the organization it the realization of scientific, scientific-technological and educational activities;
 2. The organization realizes manufacturing, service rendering, maintenance (the application of accelerator in economy, nuclear manufacture, and production of unique technological facilities, computer-informational services, media and publishing-printing activities, organization of recreation) entrepreneurship activities

directly connected with scientific and scientific-technological activities, and the income is consumed for the implementation of legislation problems;

3. Provide that the authorities of the accredited state body realizing the governance of the organizations are handed over to the Ministry of Economy of RA, entrusting it also the authorities provided by the «q», «n», «t» u «t» pre-points of the point 2 of article 13 and article 14 described in the RA code on the “state non-commercial organizations”
- 3) Confirm the organization reconstruction measures and time indicator according to the appendix
 - 4) The minister of economy of RA should:
 1. Confirm the legislation of the organization in a three-month period assigning its administration bodies, members, authorities and structure;
 2. Provide the state registration of the organization by own funds.
 - 5) The state support of the organization is realized according to an annual program. The implementation of the program funding is reflected in the state budget with a different line: at least 500 000 000 drams.
 - 6) The minister of Finance of RA when planning the RA annual budget should provide the Ministry of Economy with a sum of 500 000 000 drams for the maintenance and development of the organization scientific infrastructure, and for international scientific cooperations.
 - 7) This decision is valid the day after the publication.

Attachment 5.

Constitution of the ANL

RA
Prime Minister
Tigran Sargsyan

Printed 5 copies

Compiled on 29.09.2010 and consists of 11 pages

Copy

“Has been registered”

“Has Been Confirmed”

By the Republic of Armenia State Registration
Office for Legal Entities, Mashtots district
department

07.03. 2002թ

Registration N 27121002287

Certificate N 03U053825

By the Republic of Armenia
Minister of Economy and Trade “ ”
“ ” 2010

Number ----- Decree

Minister

N. Yeritsyan

The 07.03.2002 registered charter number “ ”
Alteration has been registered by Mashtots
district department of the RA State
Registration Office for Legal Entities , “ ” “ ”
2010.

Head of The Mashtots district

department _____ H. Petrosyan

“A. I. Alikhanian National Scientific Laboratory”
State Non-Commercial Organization

Charter
Yerevan 2010

1. GENERAL PROVISIONS

1. “A. I. Alikhanian National Scientific Laboratory” is a non-profit non-commercial organization with a status of a legal entity (hereinafter, State Organization).

According to the RA Government decision number N 758-N dated June 17, 2010 performs as the legal successor of the “A. I Alikhanian Yerevan Physics Institute” non-commercial state organization, founded according to the RA government N98 decision dated February 2, 2002. The “A. I Alikhanian Yerevan Physics Institute” non-commercial state organization was founded through the reorganization of the “Yerevan Physics Institute” state organization (registered by state register of enterprises on 19.08.1994, registration N 271.140.00080, certificate N012001977), presenting as its legal successor according to the deed of assignment

2. In the course of its existence the organization is governed by the Civil Code of the Republic of Armenia “Concerning State, Non-Commercial Organizations”, “Concerning Procedures for Scientific and Scientific Technologies”, laws and regulations of the Republic of Armenia, other legal acts and this charter.
3. The founder of the YerPhI is the Republic of Armenia under the Government of the Republic of Armenia
4. The name of the organization is:

In the Armenia language (full): «A. I. Alikhaniani anvan azgain gitakan laboratoria» Petakan Voch-Arevtrayin Kazmakerputoun

In Armenian shortcut: AAGL POAK

In the Russian language: «Natsionalnaia nauchnaia laboratoria imeni A. I. Alikhaniana» gosudarstvennaia nekommercheskaia organizacia.

In Russian shortcut: GNKO NNLA

In the English language: «A.I.Alikhanyan National Scientific Laboratory» Non-Commercial State Organization.

In English shortcut` SNCO AANL:

5. The juridical address of the organization is 2 Alikhanyan Brothers St., Yerevan 0036, Armenia

3. THE SUBJECT AND OBJECTIVE OF THE ORGANIZATION ACTIVITY

6. The main objectives of the organization are:

- 1) Implementation of scientific activities.
- 2) Implementation of scientific- technological and innovational activities
- 3) Implementation of educational activities

7. The main subject of the organization activity is the implementation of fundamental and applied researches and the further development in the fields of nuclear,

elementary particles, cosmic ray physics, astrophysics, accelerator physics and techniques, theoretical physics, cosmic weather and atmospheric phenomena and other fields, as well as training of scientific personnel for these fields.

8. The main directions of the scientific and scientific- technological activities of the organization are:

1) Fundamental scientific researches in the following fields:

- a. Nuclear physics
- b. Theoretical physics
- c. Physics of elementary particles
- d. Physics of cosmic rays and astrophysics
- e. Accelerator physics and techniques
- f. Condensed matter physics
- g. Biophysics
- h. Application of nuclear physics technologies in related natural sciences
- i. fundamental researches in other fields

2) Scientific-technical and technological developments

3) Training of scientists, engineers and technicians

4) Informational technologies and the automatation of scientific researches.

5) Scientific, scientific- technological and other fields within the scope of the organization activities.

9. To meet its objectives the Organization implements the following activities:

1) Implementation of fundamental and applied researches and creation of scientific-technical and technological developments. Researches and developments in the fields of natural sciences and engineering, implementation of scientific-technical expertise.

2) Implementation of scientific and scientific- technical projects by financial assets provided by RA (state-provided assets for the implementation of scientific, technical and technological projects in RA), international organizations, funds, foreign companies and private entrepreneurs.

3) Creation of infrastructures in the science intensive directions for the modern technologies, high- tech developments, their introduction in the market and industrial fields..

4) Developments of the organization's infrastructures, secure the effective operation of the experimental and product processing base.

5) Production of technological devices and materials.

6) Expertise and analyses in the areas of nuclear safety, chemistry, biology, and environmental protection

- 7) Organization of educational programs on fundamental physics, related technologies, and the organization's main directions
 - 8) Implementation of scientific and scientific-technical cooperations with international organizations.
 - 9) Computer-informational services.
 - 10) Development of the GRID scientific-informational system and the organization of its activity.
 - 11) Metrological services (scientific and industrial metrology)
 - 12) Organization of recreation
 - 13) Reporting, News-release, and scientific publication activities
 - 14) Repair, development, of the main infrastructure of the organization as well as new capital construction.
 - 15) Implementation of socio-domestic programs and social security measures of the employees of the organization.
10. State Organization may be engaged in entrepreneurial activity by the procedure envisaged by law.
 11. State Organization may be engaged in certain types of activities only with special licensing/special permission to carry out such practice.

4. RIGHTS AND RESPONSIBILITIES OF THE ORGANIZATION

12. Organization is considered created from the moment of its state registration.
13. The organization has separate balance sheet, can open bank accounts in the Republic of Armenia and other foreign countries in the currency of the Republic of Armenia, as well as in foreign currency, as stipulated by law.
14. State Organization has a round seal with the image of the Republic of Armenia Coat of Arms and the organization's Armenian, Russian and English name. State Organization may have blanks with its name, logo and other means of its own identification.
15. State Organization shall account for its duties with the property belonging to it.
16. The rights of the organization can be restricted only in accordance with the order defined by law.
17. State Organization shall not take a responsibility for the founder's liabilities, and the founder for the Organization liabilities, except the liabilities associated with the establishment of the organization and generated before the state registration of the Organization.
18. The Organization can have representations, branches and institutions, established upon the founder's decision.
19. The Organization may become a founder or partner for another Organization only upon the founder decision.

20. Founder may attach any asset to State Organization by the right of use with non-term limits and without compensation.
21. State Organization has no right to alienate, mortgage, deliver for use without compensation the attached assets or the rights thereon.
22. Profit yielded in the course of activity of State Organization shall become the organization property.

5. PROPERTY OF STATE ORGANIZATION

23. Property of State Organization at the time of its establishment and in future shall be formed from property delivered by the founder, as well as the property that is produced and obtained during the activity of the State Organization. State Organization has right to possess, use and manage it.
24. The founder shall not exercise rights towards the property belonging to State Organization by an ownership right, except for the property left after liquidation of State Organization.

6. MANAGING BODIES OF STATE ORGANIZATION

25. The management of State Organization shall be implemented by the state and the executive bodies appointed by the founder.
26. Founder's exclusive authorities are:
 - 1) Establish the Organization.
 - 2) Set up the scope and goals of the State Organization, including the types of entrepreneurial activities implemented by it.
 - 3) The reorganization and liquidation of the Organization and other authorities stipulated by law.
27. The state body authorized by the founder is the RA Ministry of Economy in the person of the RA minister of economy (from now on the Authorized Body), who ensures its regular activity and takes responsibility for non-implementation or improper implementation thereof.
28. The authorized body shall:
 - 1) Approve of the organization's activities annual and long-term development strategic programs,
 - 2) Approve of the organization's activities annual and long-term development strategic programs financial reports
 - 3) Approve of the scientific projects and define their priorities,

- 4) Approve of scientific projects' financial reports,
 - 5) Approve of the consequent reports on the Organization's participation in important scientific projects and cooperations,
 - 6) Approve of the annual program on the conduction of scientific meetings and the scope of participation,
 - 7) Approve the composition of the property belonging to the State that is delivered to State Organization by ownership right and(or) attached to it;
 - 8) Approve of the Organization's charter and its amendments,
 - 9) State and approve of the Organization's governing system, develop its advisory, control and management bodies, appoint the executive body of the organization, sign employment contracts with the executive body members, defining the remuneration conditions in the case of its premature termination
 - 10) State the organizations advisory body's structure, membership and operational procedures.
 - 11) To appoint the organization's dissolution committee members and approve of the liquidation balance
 - 12) Excercise Control over the activities of the organization.
 - 13) Suspend or recognize invalid the orders, instructions, directions and directives of executive body or collegial management body of State Organization, that contravene the requirements of the Republic of Armenia legislation.
 - 14) To approve of the organization's activities financial reports, the results of its audit activities, annual reports and balance.
 - 15) Control over the state property maintenance and usage.
 - 16) Approve of that property acquisition agreements which costs exceed the 20% of the organization's assets.
 - 17) Approve of the contracts connected with the alienation, mortgage, and lease of property.
 - 18) Form branches and representations.
 - 19) perform other functions provided by this law, the founder's decision and Charter of State Organization.
29. To realize its authorities the authorized body forms an International advisory body of xperts (hereinafter referred to as body of experts) and management advisory body.
30. The body of experts examines the proposals and submits them to the authorized body for the latter to implement the authorities determined by the article 28, point 1 and 6 of this charter.

31. The body of experts' staff election procedure is set by the Authorized body. The body of experts involves world- renowned scientists (with their consent). The structure and procedures of the body of experts are defined by the authorized body.
32. The administration advisory body examines and submits proposals to the Authorized body for the latter to implement the jurisdictions determined by the article 28, points 7 and 19 of this charter
33. The administration advisory body's staff, structure and procedures are determined by the Authorized body. The president of the management advisory body is the head of the Authorized body
34. The current activities of the organization are managed by the executive body, which involves director and deputy directors. The executive body is elected on a competitive basis and is appointed by the authorized body with maximum 5 years term.
35. The director manages the work of the executive body.
36. After the appointment of the director, an employment contract is signed between the Authorized body and the director.
37. Director of the organization shall:
 - 1) Act on behalf of the organization, represents its interests in Armenia and abroad, issue letters of authorization for the right of representing the Organization, including letters of re-authorization.
 - 2) Hire and dismiss employees of the organization, apply incentives and assign disciplinary penalties
 - 3) Manage the organization property and the financial assets
 - 4) Sign contracts, including employments contracts
 - 5)) perform job distribution among the employees in compliance with the Authorized body's adopted regulations
 - 6) Open bank accounts
 - 7) With the approval of the Authorized body establish the regulations of the Organization's institutions, branches and its representatives, appoint their heads.
 - 8) Within the scope of the authorities defined by law and the Charter of State Organization issue orders, directions, provide compulsory instructions and control over their implementation.
 - 9) Exercise other authorities not contravening the RA legislation and this Charter

38. The scientific council is a collegial advisory body coordinating the organization's scientific-technical activities, and which activity is governed by Scientific technical staff regulations.

39. The scientific council consists of 25 members, whose candidacies are nominated by the scientific staff of the organization.

The council staff is confirmed in a 3- year term by the director. Director of the scientific council is elected from among the council members.

The authorities of the scientific council are:

- 1) To submit recommendations on main directions of the organization's scientific and scientific-technical activity.
- 2) To discuss scientific and scientific- technical related issues, as well as submit recommendations to the Authorized body and the director.

7. CONTROL OVER THE ORGANIZATION'S ACTIVITIES

40. Founder, authorized state body, bodies authorized by the founder and other state management bodies as prescribed by the Law may implement control over the activity of State Organization.

41. State Organization shall be obliged to promulgate its yearly financial reports by the order set by the founder

8. REORGANIZATION AND LIQUIDATION OF STATE ORGANIZATION

42. The organization can be reorganizaed or liquidated upon the founder's decision, by the procedure defined by the Civil Code

43. State Organization may be reorganized into a company or a fund with 100 percent of state participation.

44. Where a State Organization is liquidated, the rest of the property shall be directed to the State Budget after the creditors' claims are satisfied.

Attachment 6.

Prime Minister

DECREE

December 1 2010, 1049 - U

On the creation of advisory body of experts for the “A. I. Alikhanian National Science Laboratory” non-commercial state organization with Yu. Ogannisyan appointed as its head.

In accordance with the RA president July 18, 2007 ՆՀ-174-Ն decree, order set in point 1, subparagraph 2 of paragraph 121:

1. To increase the efficiency of the A. I. Alikhanian National Science laboratory non-commercial state organization and to submit corresponding proposals to the RA prime minister, create an advisory body of experts headed (with the consent of) by Yu. Ogannisyan- the scientific leader of the G. Frolov Nuclear Reactions Laboratory (the Russian Federation, Dubna), academician of the Russian academy of Sciences.

2. Suggest that Yu. Ogannisyan should submit to the RA prime minister the candidacies of world-renowned scientists to be involved in the experts' advisory body described in the paragraph 1 of this decree.

Attachment 7.

**RA Government
DECREE N 1424 -Ն
7 October, 2010**

On the approval of the program on the creation of Armenian Oncology Center of Excellence, the foundation of “Radioisotope Production Center” CJC and inserting amendments in the RA government February 19, 2009 decree N 310-Ն

In compliance with the RA government April 28, 2008 decree N 380-U –provided Annex 4.4.1 of paragraph 2nd, the paragraph 1 of the RA government decree N 310-Ն, dated February 19, 2009, paragraph 4 of the Article 10 and the paragraph 5 of the Article 12 on the RA law on “Joint companies”, the RA law Article 19 on the “Budget system”, the RA government decides:

1. In compliance with the Annex N1, approve the program on the creation of Armenian Oncology Center of Excellence consisting of radioisotope production complex, diagnostic center-furnished with positron emission tomography, and oncological clinics.
2. Suggest that the RA National Competitiveness Foundation should support the development of nuclear medicine in RA and manage the works on the creation of Oncology Center of Excellence in RA, including, cyclotron purchase, transportation, commissioning and coordination of corresponding constructional works; management and enrollment of the acquired professional personnel, provision with diagnostic devices, and conduction of negotiations with potential investors, compilation of required contracts, preparation of legal documentation drafts, cooperating with the RA Ministry of Economy and the Ministry of Health.
3. The RA Minister of Health shall:
 - 1) With the support of the RA National Competitiveness Foundation director implement:
 - a. Conclusion of a contract with the Belgian «ABA molecular» organization on the acquirement of “CYCLON18/18”
 - b. In cooperation with the RA Minister of Finance conclude a loan agreement with the Belgian “BCNV» on the cyclotron acquisition funding on behalf of RA
 - 2) Authorize to conclude with the Belgian “ABA molecular” organization a contract on the acquisition of “CYCLON 18/18” on behalf of the RA.
4. The RA Minister of Health shall develop and insert the oncology medical aid standards and procedures including the nuclear medicine application-provided practical components: examination, diagnosis and treatment, and set the sanitary norms and rules of radioisotope production and staff safety in accordance with the RA legislation.
5. Starting from 2011, the RA minister of education and science shall provide the training of professionals in the nuclear medicine field in corresponding RA and

international universities and scientific organizations, with the financing allocated from the RA state budget high education programs.

6. Found “Radioisotope production center”, a CJO with 100 percent of state participation (hereinafter organization). Reserve the rights to establish the charter of the organization, execute the required procedures for its state registration and to realize other law-defined authorizations of the organization’s founder, as well as the stock (possessed by the organization by ownership rights) management authorities, to the RA Ministry of Economy.
7. State the organization’s chartered capital 5000000 drams, which is equal to 5000 common stocks, each with 1000 drams nominal value.
8. Minister of Economy shall establish the Charter of the organization in one month, as stipulated by law.
9. To pay the chartered capital of the organization, allocate to the RA ministry of economy a sum of 5000000 drams against the acquisition of 5000 stocks, at the expense of the RA government reserve fund, stipulated by RA 2010 state budgeting (due to the budget expenses’ economical classification Article “Acquisition of inner stocks and shares”).
10. Provide that the council consists of 5 members, including members from the RA Ministry of Economy, RA Ministry of Health, RANational Competitiveness Foundation (with the consent of), “A.I. Alikhanian National Science Laboratory” non-commercial state organization, and the executive director of the organization.
11. The RA Minister of Economy shall submit to the RA government a proposal on the acquisition of corresponding budget loan and expertize permits for the implementation of projecting works of radioisotope production center foundation.
12. Execute the following amendments on the RA government February 19, 2009 N310-Ն decree on the “Installation of “CYCLON-30” isotope production complex in the “A. I. Alikhanian Yerevan Physics Institute” non-commercial state organization and approval of the nuclear medicine center creation program in RA”.
 - 1) In the title of the decree, paragraph 1 and the Annex replace the words “A. I. Alikhanian Yerevan Physics Institute” with “A. I. Alikhanian National Science Laboratory”.
 - 2) In the title of the decree, in paragraph 1 and the Annex replace the name «CYCLON 30» with «CYCLON 18/18»
13. This decision is valid the day after the publication.

RA Prime Minister
November 11, 2010
Yerevan

Tigran Sargsyan



Ընդամենը հատակագծի սահմաններում 33.631 հա

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