Information Day
of the Joint Research Center of EC
Kiev, 14 August 2016

National Academy of Sciences of Ukraine

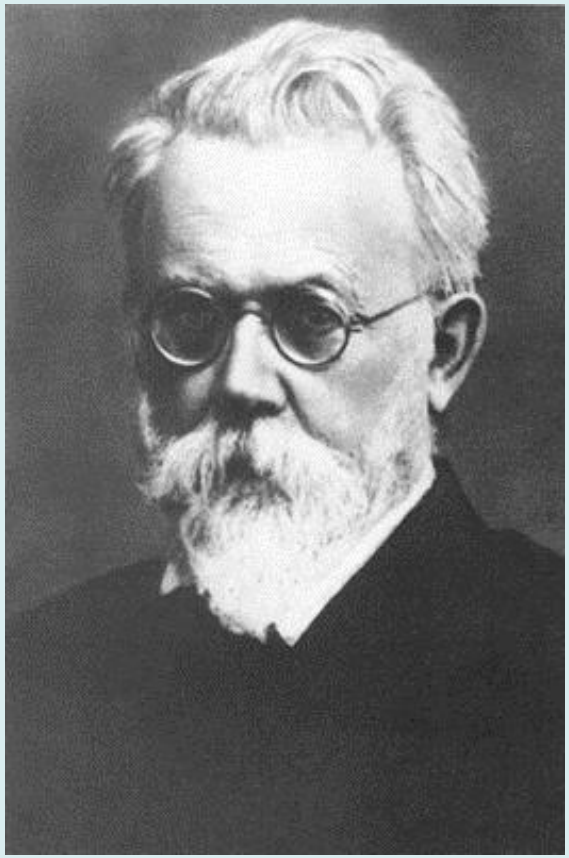
(Current status and prospects)

Anatoly Zagorodny

Vice-president of the National Academy of Sciences of Ukraine

The Ukrainian Academy of Sciences was founded in 1918 by a decree of Pavlo Skoropadsky, the Hetman of Ukraine

His Grace Hetman of Ukraine
Pavlo Skoropadsky



The founder and first President of the Ukrainian Academy
Volodymyr Vernadsky

National Academy of Sciences of Ukraine

According to the national legislation, the National Academy of Sciences of Ukraine is the highest scientific institution of Ukraine funded by the Government. It carries out basic and applied research in various fields of studies, develops scientific fundamentals for technological, socio-economic and cultural advancement of the nation. The Academy has the rights of self-government in making decisions about its own activities.

Along with basic research, the Academy carries out applied studies related to aerospace industry, mechanical engineering, electric power engineering, nuclear power industry, mining industry, mineral exploration, chemical industry, biotechnologies, etc.

The National Academy of Sciences of Ukraine consists of 3 sections:

- **physical, technological and mathematical sciences;**
- **chemical and biological sciences;**
- **social sciences and humanities**

DEPARTMENTS

Department of Mathematics;
Department of Information Science;
Department of Mechanics;
Department of Physics and Astronomy;
Department of the Earth Science;
Department of Physical and Technical Problems of Materials Science;
Department of Physical and Technical Problems of Power Engineering;
Department of Nuclear Physics and Power Engineering;
Department of Chemistry;
Department of Biochemistry, Physiology and Molecular Biology;
Department of General Biology;
Department of Economical Sciences;
Department of history, philosophy and Law;
Department of Literature, Language and Art Studies.

National Academy of Sciences of Ukraine incorporates 170 institutes.

The Academy has more than 30 000 employees, about 17 000 scientific researchers being among them.

NAS research staff includes about

2 400 doctors of science (Dr.Habil.) and 7 100 candidates of science (Ph.D.).

Centers for the Shared Use of Scientific Equipment

81 interinsitute centers for the shared use of equipment are founded at 59 institutes; 209 scientific experimental set-ups and devices are used there: 5 machines for mechanical testing; 19 transmission and scanning electron microscopes; 5 atomic-force microscopes, 19 optical microscopes, 18 spectrometers, 22 mass-spectrometers; 8 spectrophotometers; 6 X-ray diffractometers; 8 magnetometers; 4 gas analyzers; 23 PCR systems and equipment for biological and medical research.

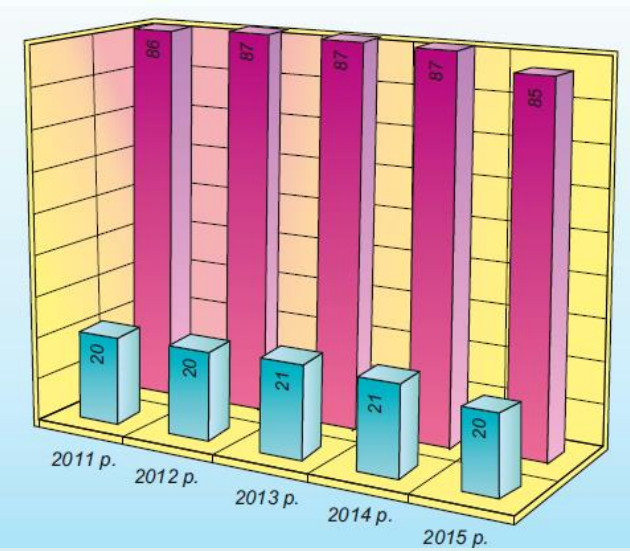
TECHNOLOGY RARKS:

‘E.O. Paton Electric Welding Institute’

‘Institute for Single Crystals’

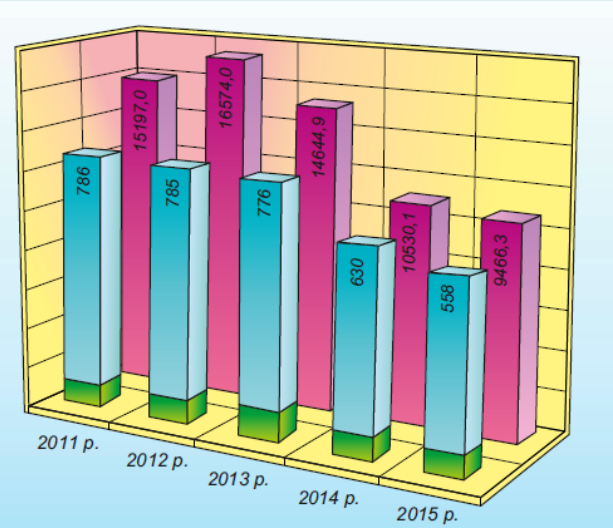
‘Semiconductor technologies and materials, optoelectronics end sensor devices’

PUBLISHING ACTIVITIES



Scientific periodicals

Annually more than 80 scientific periodicals are published by the institutes of NASU, 20 of them are republished abroad.



Books

About 500 books (monographs, proceedings, collection of papers etc) are published by the researchers of NASU in Ukraine and abroad.

The first 15 scientific organizations and higher education institutions in the ‘Scopus’ international database as evidenced by the Hirsh index

Scientific organizations, higher education institutions	Number of publications	Number of citations	h-index
M.M. Bogolyubov Institute for Theoretical Physics	2766	33523	74
National Science Center ‘Kharkiv Institute of Science and Technology’	4675	34959	73
Taras Shevchenko Kyiv National University	*12416*	*49991*	*70*
Institute of Physics	3634	29285	65
Bogomoletz Institute Інститут of Physiology	2344	20049	58
Institute for Nuclear Research	2263	18939	58
Institute of Molecular Biology and Genetics	1910	18812	58
B.Verkin Institute for Low Temperature physics	4446	31195	56
Institute of Bio-organic and Oil Chemistry	1152	12418	56
Main Astronomical Observatory	926	14384	55
V.N.Karazin Kharkiv National University	*7117*	*31308*	*54*
G.V. Kurdyumov Institute for Metal Physics	2741	19947	54
I.M. Frantsevich Institute for Materials Problems	6987	23469	53
Palladin Institute of Biochemistry	1891	12226	53
V.Lashkarev Institute of Semiconductor Physics	4088	22934	51

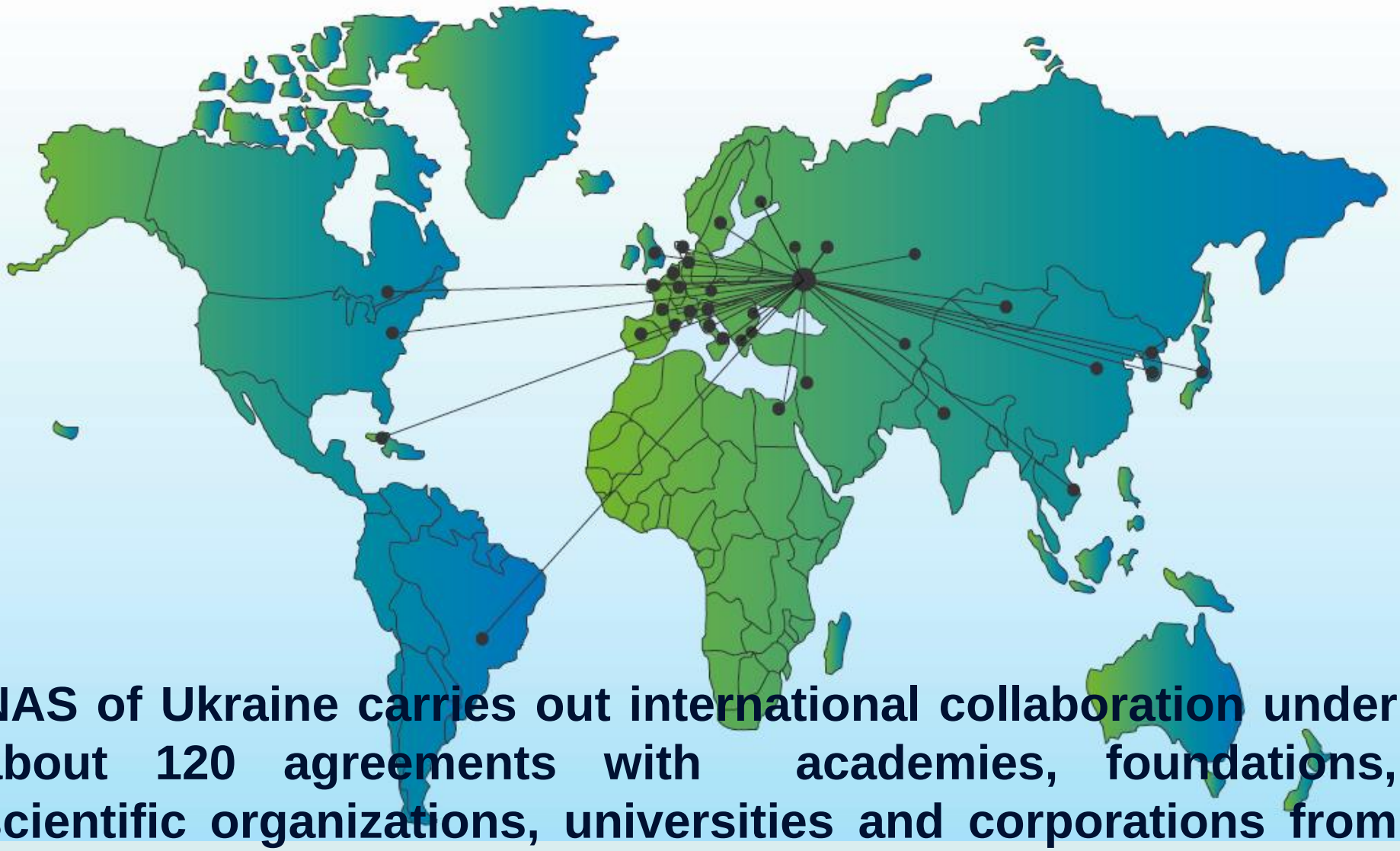
- NAS institutions

NASU and Universities

1300–1400	Scientists of NASU are teaching at universities
5 – 10	Common research-educational structures are operated to train skilled specialists
3500–4000	University students are trained yearly at NASU institutes
30–35	Former “Junior Academicians”, then university graduate students, join yearly NASU institutes
≈ 200	Common scientific projects carried out by NASU and universities
≈ 100	Common monographs are published annualy
≈ 100	Common textbooks are published yearly
270–290	Ph.D. and Dr. hab. dissertations are yearly defended at NASU institutes by students and scientists from the universities

At present, NASU and MES of Ukraine are founding the Kiev Academic University – a pilot project of research university which will use the European standards.

International Collaboration

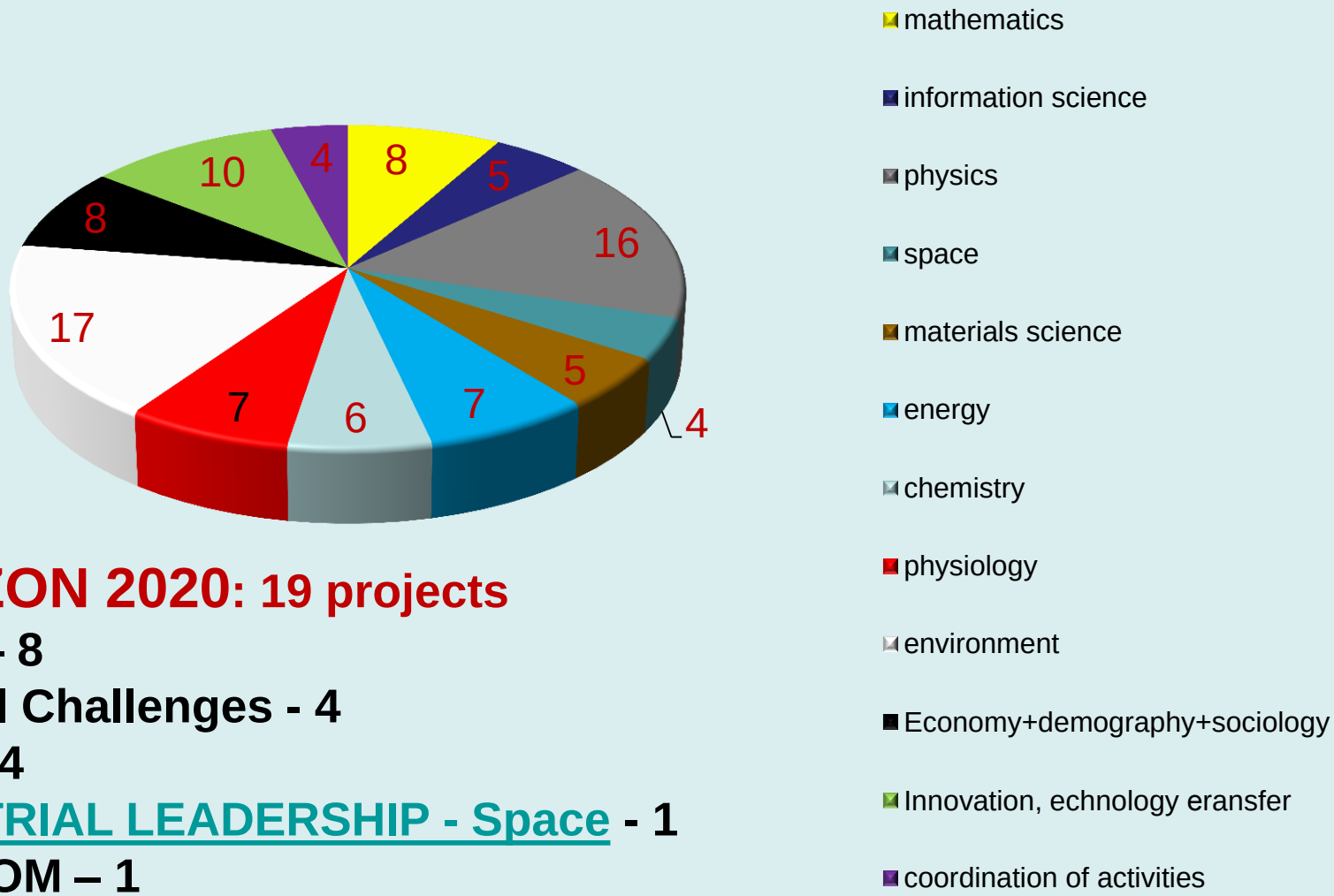


NAS of Ukraine carries out international collaboration under about 120 agreements with academies, foundations, scientific organizations, universities and corporations from 50 countries.

Scientific and technical cooperation of NAS of Ukraine with international organizations

- NAS of Ukraine - EU programs
- NAS of Ukraine - NATO programs
- NAS of Ukraine – UNESCO program "Man and Biosphere"
- International Atomic Energy Agency (IAEA)
- European Organization for Nuclear Research (CERN)
- International Institute for Applied Systems Analysis (IIASA)
- Science and Technology Center in Ukraine (STCU)
- Joint Institute for Nuclear Research (JINR)
- Central European Initiative
- Joint Research Center

FP7: 97 projects involving 52 NAS entities, over EUR 7.4 mln



HORIZON 2020: 19 projects

- **MCSA – 8**
- **Societal Challenges - 4**
- **INCO – 4**
- **INDUSTRIAL LEADERSHIP - Space - 1**
- **EURATOM – 1**
- **ENVIRONMENT -1**

Ukrainian National Grid

35 clusters, ~4500 CPU,
~500 TB (HDD), ~500 TB (SE).

International Collaboration of UNG

AstroGrid-D

UN-SPIDER

International Educational Grid. Its Center is in JINR

Russian Grid

International Desktop Grid Federation

Ukraine signed MoU with WLCG (Worldwide LHC Computing Grid) on April 25 in 2006.

TOPMOST RESULTS IN FUNDAMENTAL RESEARCH

High energy physics and astrophysics (participation in the experiments at the Large Hadron Collider, the discovery of new galaxies based on observations with the "Hubble" telescope, discovery of the spectrum which can be treated as indicating the existence of dark matter particles, participation in the experiments of the "BOREKSINO" Collaboration for measuring the power of solar radiation at the moment of energy release of in the depths of the Sun).

Condensed matter physics (the study of electronic properties of graphene, BEC in magnetics at room temperature, control of the properties of liquid crystals).

Radioastronomy (the finding of highly excited atoms (with the main quantum number of the order of 400) in the interstellar space, the discovery of lightning in Saturn's atmosphere).

TOPMOST RESULTS IN FUNDAMENTAL RESEARCH

Molecular biology and genetics (discovering of the molecular mechanisms of reception and transmission of pain signals to the brain, development of a new nanobiosensor, creating effective nanobiofarmacy preparations).

Biochemistry (basic data on the mechanisms of the formation of Alzheimer's disease).

Physical chemistry (nano-photo-catalysis, new methods of fabricating graphene-like structures on the surface of nanoparticles).

Materials sciences (new composite materials with predictable properties, new welding techniques, including living tissues welding, the study of the microscopic structure of titanium alloys).

Annually about 2000 research projects are performed in the field of basic sciences. About 500 books, 400 textbooks and 20000 papers are published every year.

APPLIED RESEARCH

ENERGY

- Compatibility and adjustment of the Ukrainian and European electric power grids.
- Research directed to solving operational problems of coal-mining enterprises
- ‘Fundamental aspects of renewable and hydrogen energy and fuel-cell technologies’.
- Updating municipal heat-and-power systems

NUCLEAR ENERGY

- Scientific support of the development of nuclear power industry and promising nuclear technologies
- Qualification of the fuel Westinghouse elements ;
- Testing of sample-wetness from the reactors of NPP

MEDICINE

- New equipment and devices for medical diagnostics and treatment ;
- Nanobiopharmacy;
- Welding of living tissues

AEROSPACE INDUSTRY

- New materials;
- Scientific maintenance of the activities of the “‘Pivdenne’ State Design Burea”
- Collaboration agreement with ‘Antonov’ State Company

AGROBUSINESS

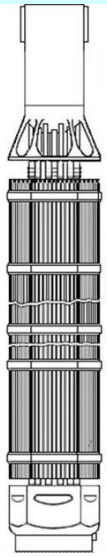
- Breeding new varieties of crops
- Biodiesels technologies

Testing the properties of samples-witnesses makes it possible to estimate the state of the reactor vessels of the Ukrainian NPPs and recommend to extend their operation. The term of operation for 6 NPP reactors (of 15 operating in Ukraine) is prolonged for the period from 10 to 30 years .

E.g.: the residual resource for SUNPP - 3 reactor was prolonged until 2050 and for ZNPP - 4 reactor until 2047. This makes it possible to save 1.5 Billion UAH annually

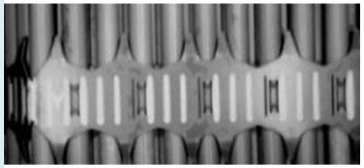
The qualification of the nuclear fuel produced by the US company «Westinghouse» for Ukrainian NPPs. The safety and efficient use of this fuel under combined load of WWR -1000 core was substantiated. In 2016, 5 of 13 nuclear reactors in Ukraine started to use Westinghouse assemblies, which allow to save 1.3 billion UAH this year.

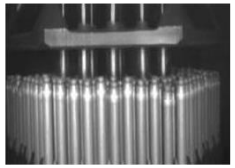
(Kharkiv Institute of Physics and Technology).



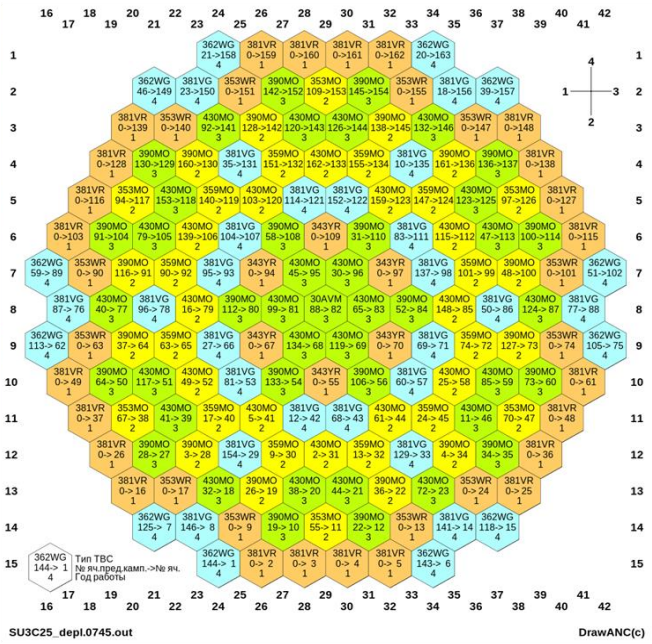
Загальний вигляд тепловидільні збірки ТВЗ-WR

Проведення контрольних операцій з перевірки форми ТВЗ-WR





Візуальний контроль ТВЗ-WR після кожного року експлуатації



Картограма 25-ого змішаного паливного завантаження енергоблоку № 3 ПУАЕС (коричневим кольором показано тепловидільні збірки-WR зміцненої конструкції)

Molecular Breeding and Genetic Improvement of Wheat Varieties

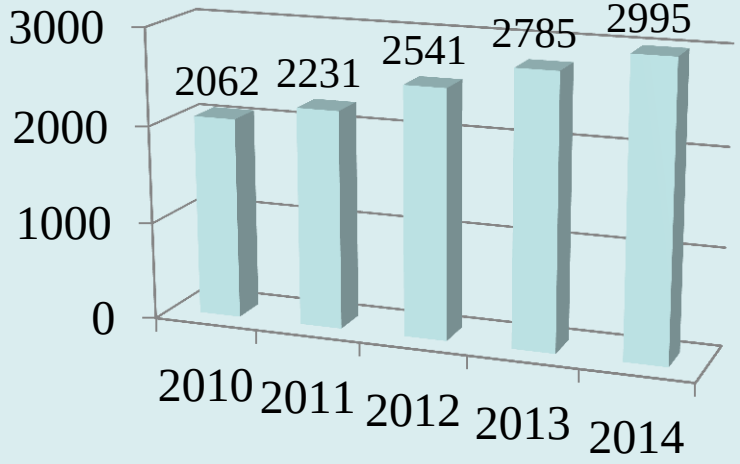
Semi-dwarf family varieties have accomplished a "green revolution" in the world grain production

The yield capacity of obtained semi-dwarf wheat varieties is 110-115 quintals per hectare

Over 140 varieties of crops have been created. They have been sown for 37 years on the areas of 1.0–5.5 million hectares annually.

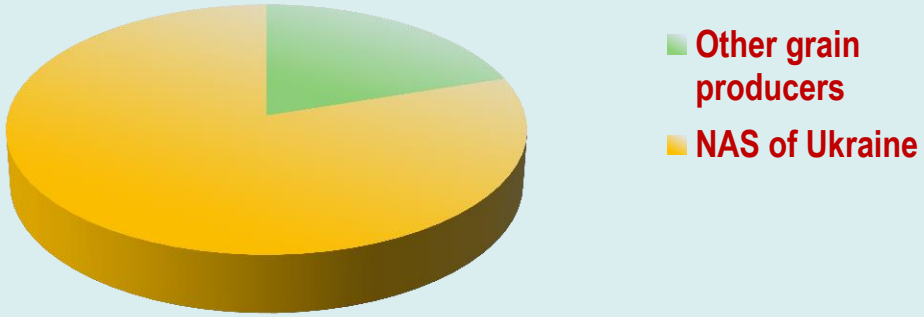
Some of them have formed the record-setting yield of 124 – 131.8 quintals per hectare.

License Agreements



1.75 mln. hectares are sown by wheat varieties bred at the NAS of Ukraine

The wheat harvested from those areas can meet the needs of Ukraine in food grain nearly in full.



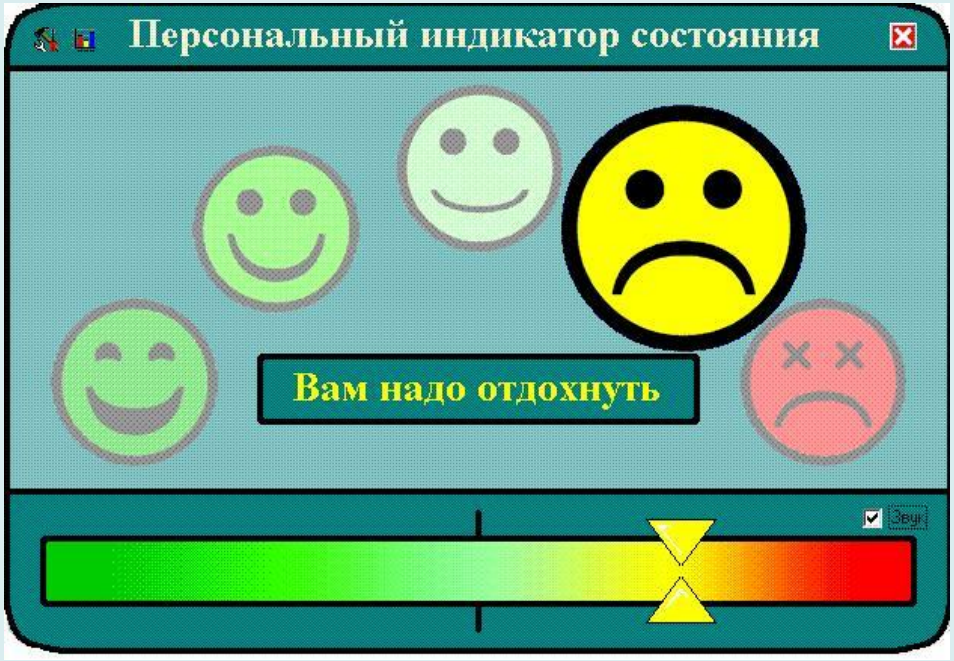
Electric welding of living tissues

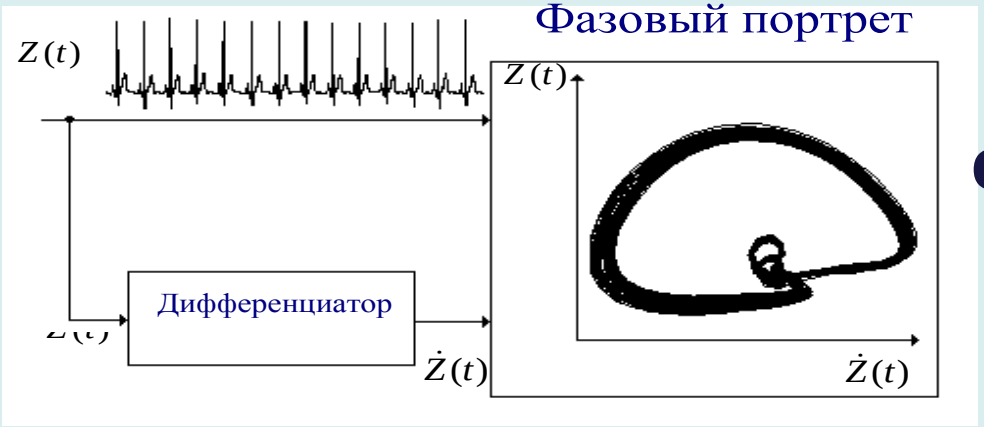
130 applications are proposed for surgery, traumatology, pulmonology, proctology, gynecology, otolaryngology, ophthalmology, vascular surgery etc.

200 thousand patients were operated on

Special welding equipment for surgery operation is constructed and produced

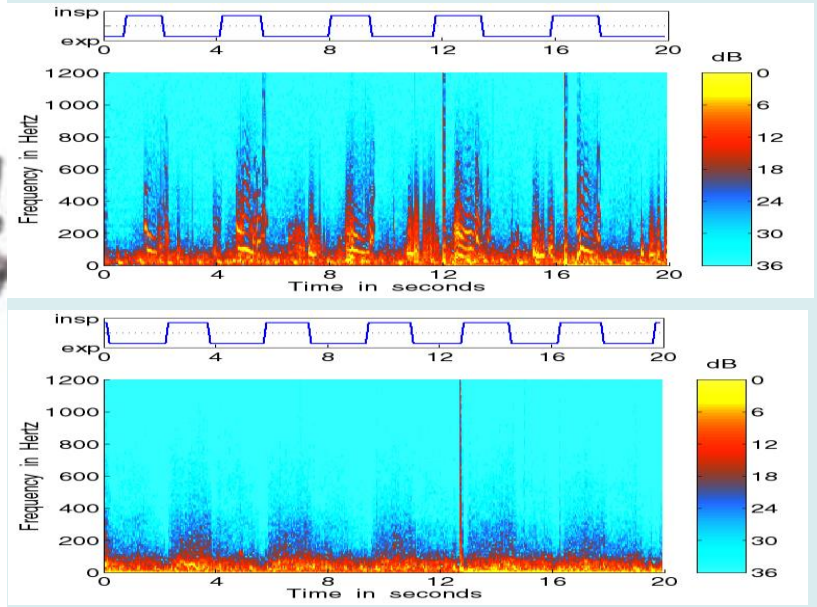
Фазограф®





Pocket ECG for quick cardiograms compatible with your smartphone

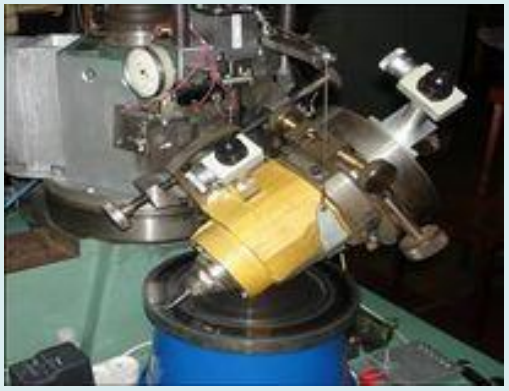
Phonospirographic computer complex for diagnosing pulmonary diseases



New methods of strabismus treatment in child and production of optical Fresnel lenses for special glasses







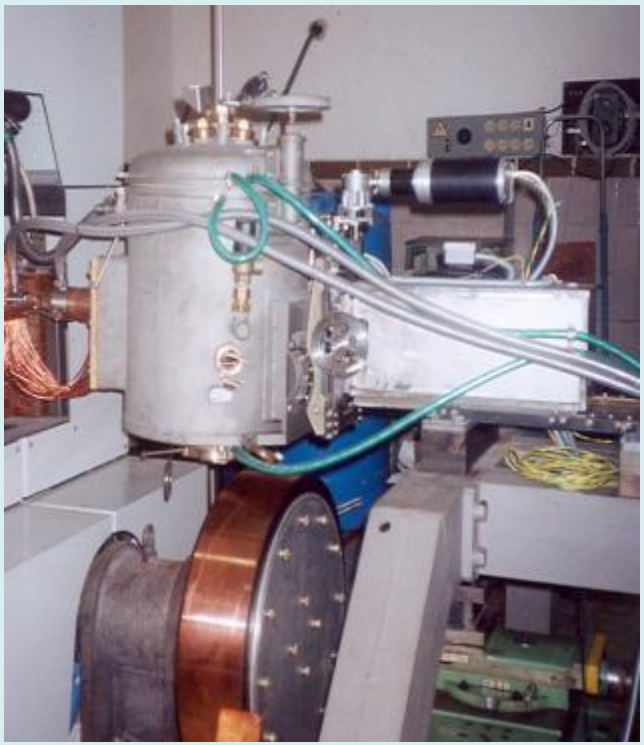

The method of targeted transport of drags to tumor is proposed on the basis of biocompatible nanocomposite (cisplatin + ferromagnetic fluid) using constant magnetic field.

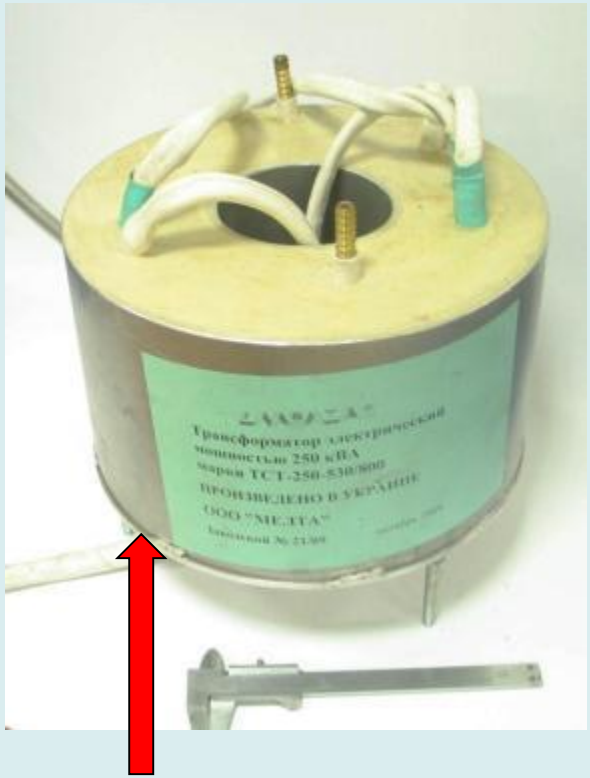
Bio-ceramic implants for reconstruction of damaged bone are proposed

Intellectual technologies for image processing

The first sapphire optical disc for "eternal" (about 10 thousand years) information storage is created.

Nanocrystalline magnetic cores and their products





The transformer capacity of 250 kVA.

Due to the using nanocrystalline magnetic core the transformer weight is reduced 10 times

About 1 million of nanocrystalline cores of various application are already produced

Earth Sciences

New methods of prospecting for promising mineral resources (oil, gas, metals, etc.).

Remote sensing of the Earth's surface.

Intensification of oil and gas production.

Marine research.

Hydrogeology of drinking and mineral water.

Seismic monitoring.

Meteorology, climate

Nano-biopharmacy

Employed in developing:

new drugs against type II diabetes and cancer;

new components of anti-thrombogenic drugs;

new bio-ceramic implants;

carriers of pharmaceuticals;

antimicrobials;

new test systems

The Academy is involved into preparation of the Ukrainian proposals to the Smart Specialization Strategy. According to the Order of the Deputy Prime-Minister of Ukraine the Academy is responsible for the coordination of this activities.

The Academy initiated creation of new technological platform “Materials with long lasting resource” as the proposal of Ukraine to Smart Specialization Strategy of EU.

Thank you for your attention