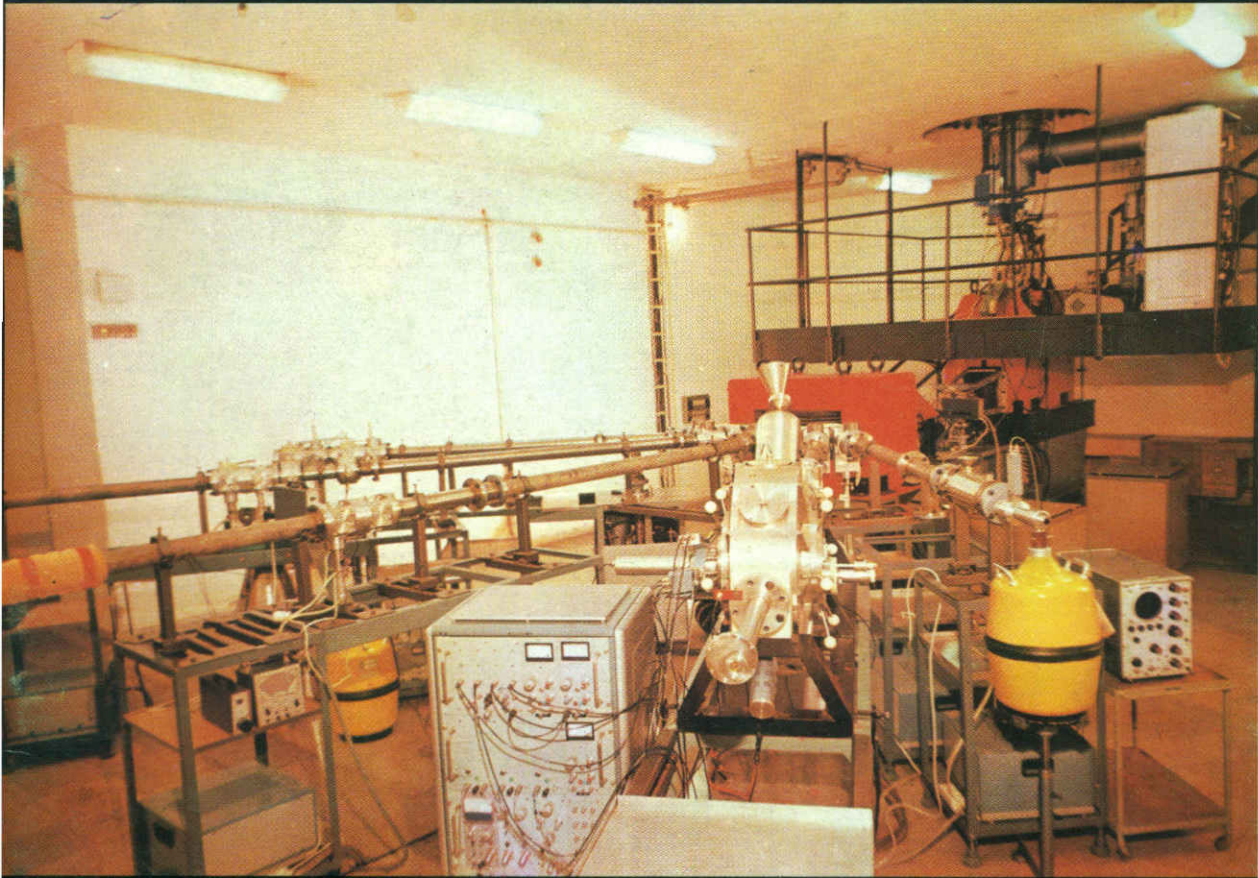
ATOMKI



Institute of Nuclear Research
of the Hungarian Academy of Sciences

Debrecen, Hungary

Front cover: Experimental channels in the main target area of the 5 MV Van de Graaff generator

Institute of Nuclear Research
of the Hungarian Academy of Sciences

Debrecen
1976

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The old buildings of the ATOMKI from the yard

Introduction

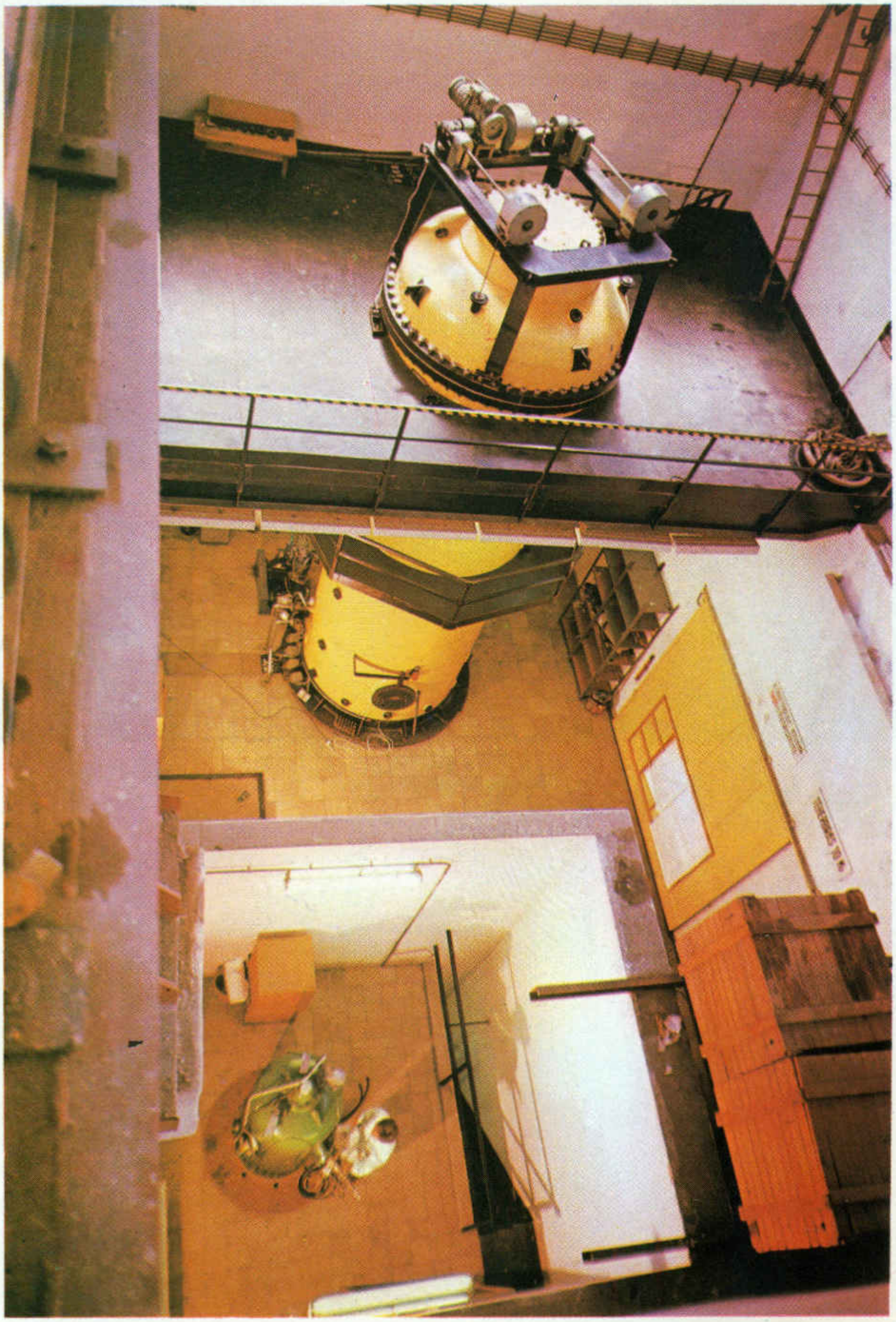
The Institute of Nuclear Research of the Hungarian Academy of Sciences (abbr.: ATOMKI) developed from the Institute for Experimental Physics of Kossuth University, Debrecen. In the Institute for Experimental Physics nuclear research was initiated in 1936 by A. Szalay, the founder and the former director of ATOMKI for more than two decades. After having returned from study-tours abroad, he pursued his work in Debrecen under rather unfavourable conditions with the help of but a few enthusiastic people. After the liberation that work resulted in the developing of the "Debrecen scientific school of nuclear physics" and in the foundation of this Institute in 1954.

The Institute works at present with a relatively small but experienced staff (at present more than 200, including about 65 research workers) and with modest facilities. This very fact determines the choice of topics; the Institute tries to tackle problems of nuclear physics that require relatively modest instrumentation but much effort and inventiveness, as well as problems relevant to other fields of science.

The achievements attained by ATOMKI are well illustrated by the following data: more than a thousand papers have been published, about one third of them in international journals. More than forty dissertations for the (university) Doctor's Degree, twenty-five ones for the "Candidate in Physical Sciences"(CSc) degree, four of them by foreign physicists, four for the "Doctor in Physical Sciences" (DSc) degree have been submitted and defended. (The last two degrees are granted by the Academy of Sciences.) Three scientists of the Debrecen scientific school of pure and applied nuclear physics (A. Szalay, D. Berényi and J. Csikai) have been elected members of the Hungarian Academy of Sciences.

The scientific results and social role of the Institute are recognized. Many prominent personalities, scientists and statesmen (among others Pál Losonczi, President of the Presidential Council of Hungary), have paid visits to the Institute, and several members of the Institute have been awarded orders and prizes of the state, the Academy of Sciences and the Roland Eötvös Physical Society.

The new buildings



View of the 5 MV and 1 MV Van de Graaff generators

Scientific activities

Nuclear structure and reaction studies

Nuclear structure and reaction mechanism are investigated both experimentally and theoretically in this Institute. Some investigations adjacent to this field will be discussed among applications.

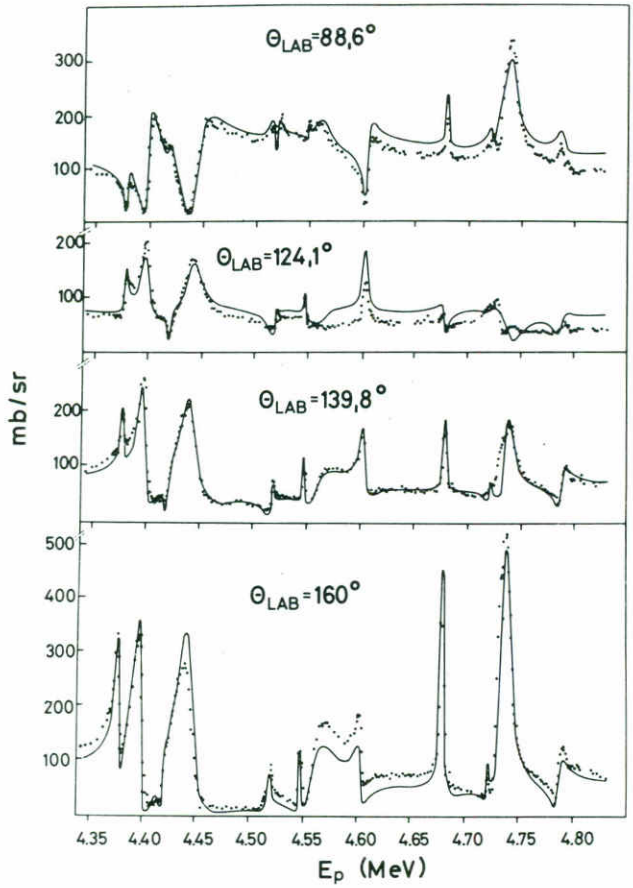
Nuclear spectroscopy

In 1963 close cooperation was established with the Laboratory of Nuclear Problems of the Joint Institute for Nuclear Research, Dubna. Dr. T. Fényes and his group took part in the planning and technical preparation of the program "YASNAPP", and their work in Dubna and Debrecen has contributed to its realization. The aim of the research in this program was the production of new isotopes and an extensive spectroscopic investigation of *nuclei far from the stability line,* especially in the region of Tl, Hg, Au and the rare earth elements. In the course of thirteen years of collaboration about fifty isotopes of sixteen elements were investigated. The most important result was the discovery of ten new isotopes or long-lived isomers of these elements and the determination of many of their properties[1]. The calculated energy levels and electromagnetic properties of light even mercury isotopes explain a number of experimental data and help to understand the structure of these nuclei[2].

Research on the Van de Graaff accelerators is directed towards nuclear structure studies applying several types of nuclear reactions and techniques.

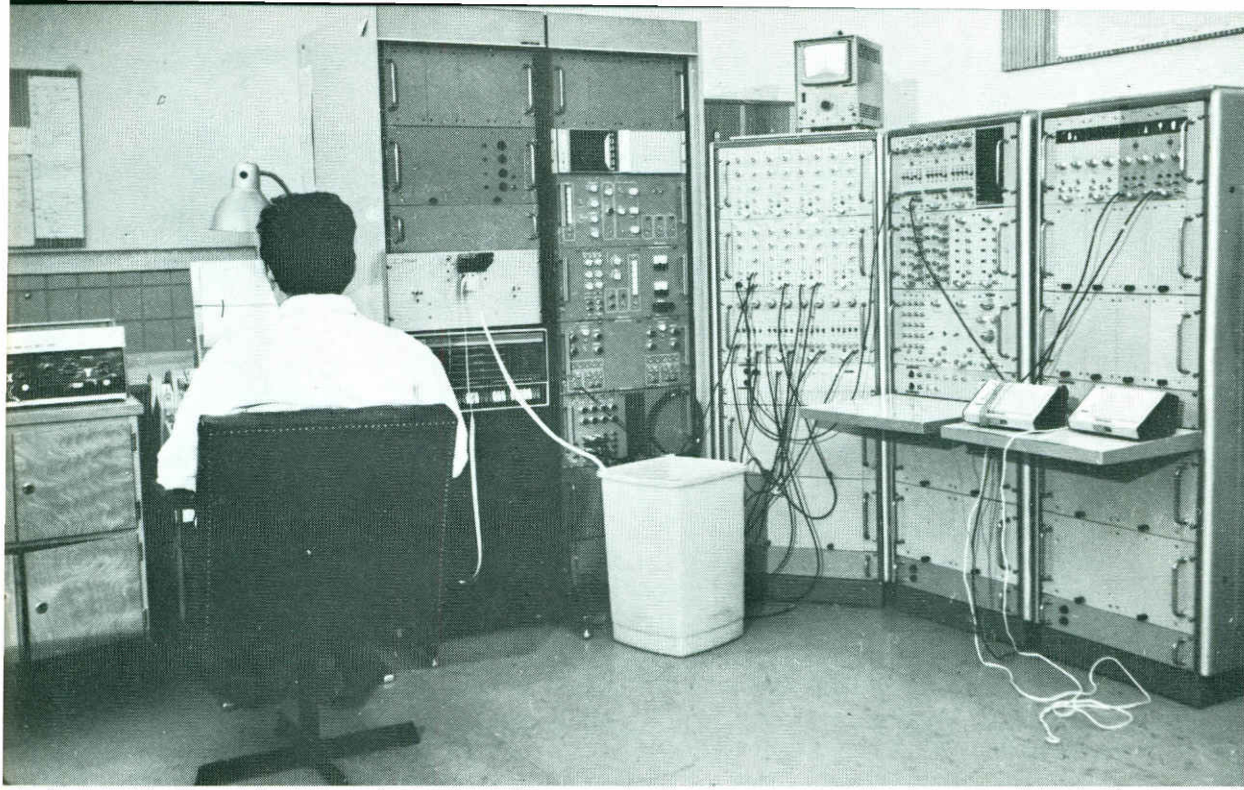
Proton *elastic scattering* studies were started in 1973 in order to determine the energy, width and spin-parity value of resonances using R-matrix theory. The first result in this field was the proton elastic scattering on ^{40}Ca between 2.3 and 4.85 MeV[3]. The elastic scattering studies have been recently extended to alpha projectiles. For the present study of the structure of ^{28}Si, (α, γ) and (p, α) reactions are also used. The solid-state detector technique for alpha particles developed in the Institute is used for detecting very weak alpha groups in quite high proton background in (p, α) reactions.

1 A. G. Demin, T. Fényes, I. Mahunka, V. G. Subbotin and L. Trón, Nucl. Phys. A106 (1967) 337
2 T. Fényes, I. Mahunka, Z. Máté, R. V. Jolos and V. Paar, Nucl. Phys. A247 (1975) 103
3 E. Koltay, L. Meskó and L. Végh, Nucl. Phys. A249 (1975) 173



Measured excitation functions (dots) and R-matrix fits (curves) for the $^{40}Ca(p, p)^{40}Ca$ elastic scattering process

In-beam gamma spectrometry with (p, p'γ) reaction and high energy-resolution Ge(Li) detectors offers an efficient tool for determining the characteristics of excited levels and constructing level schemes. The first (p, p'γ) measurements were carried out on the nucleus ^{45}Sc. The spectroscopic application of the determination of the angular distribution of particle b in an (a, bγ) process by analysing the shape of the gamma peak broadened by the Doppler effect is projected.



Data acquisition and processing system of the accelerator laboratory

Study of nuclear reaction mechanism

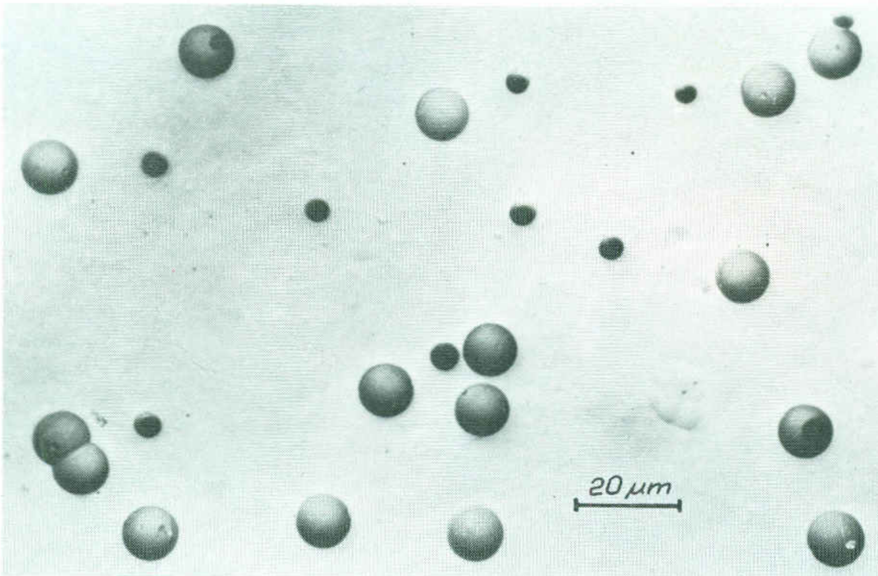
The measurement of (d, p), (d, α) and (d, n) cross-sections on light nuclei with the Cockcroft–Walton generator was done in order to study the general features and mechanism of the *sub-Coulomb-barrier particle-transfer reactions*[4].

The 14 MeV neutrons of the neutron generator have been used, among others, for cross-section measurements on isotopes of heavy elements to clear up the N–Z dependence of (n, 2n)[5] and isotopic effects in *(n, p) reaction cross-sections*. The new ^{198}Ir isotope was produced through the ^{198}Pt(n, p) reaction. The (n, ^{3}He) reaction was observed first here[6].

4 L. Meskó, B. Schlenk and A. Valek, Acta Phys. Hung. 29 (1970) 365; A. Valek, ibid. 34 (1973) 179

5 J. Csikai and G. Pető, Phys. Lett. 20 (1966) 52

6 J. Csikai and A. Szalay, Nucl. Phys. 68 (1965) 546



Tracks of two alpha-groups with different energies in a polycarbonate detector

In cooperation with the Institute of Physics and Power Engineering (Obninsk, USSR) studies have been recently started to determine the behaviour of the optical parameters of *proton scattering around the Coulomb barrier*.

One of the main fields of activity in *nuclear theory* was the description of resonant states and, in particular, isobaric analogue resonances. It has been shown that the resonance wave functions with purely outgoing spherical waves in infinity, called the Gamow functions, are very practical in applications[7]. One of the first microscopic calculations of the asymmetry term of the Lane potential was that of J. Zimányi and B. Gyarmati[8]. In a recent work the self-consistency of the Lane potential has been investigated phenomenologically. A paper has contributed to the clearing up of the role of inelastic multi-step processes in transfer reactions, other ones estimated the effect of the presence of single-particle states near the thresholds of reaction channels[9]. Further aspects of channel and particle correlation and coupling in direct and semi-direct processes are under study.

7 E. g.: B. Gyarmati and T. Vertse. Nucl. Phys. A160 (1971) 523
8 J. Zimányi and B. Gyarmati, Phys. Rev. 174 (1968) 1112
9 E. g.: B. Gyarmati, A. M. Lane and J. Zimányi, Phys. Lett. 50B (1974) 316

Application of nuclear methods in other branches of science

Although the main research area of the Institute is experimental nuclear physics, considerable interest has been taken, from the early years, in other branches of science as well. The experience gained in fundamental nuclear physics and instrument construction found its way to application in quite a number of territories of basic and applied research: in the field of the elementary interactions, pure and applied atomic physics and chemistry as well as in earth and agricultural sciences and environmental research.

Applications of nuclear spectroscopy

The methods of nuclear spectroscopy offer possibilities in studying both the fundamental interactions in the nucleus and the interactions of the nucleus with the electron cloud and other atomic phenomena. The research is concerned with the problems of weak interactions (e. g. second-class currents in beta decay), higher order effects in nuclear decay (e. g. internal bremsstrahlung, shake-off electrons in electron capture, etc.), the interactions of the nucleus with the atomic cloud (electron capture, internal conversion), chemical effects in nuclear decay, chemical structure studies, applications of electron spectrometry in other branches of science (ESCA) and inner-shell ionization induced by electrons, protons, alpha particles and heavy ions.

An earliest result, referred to in several textbooks, was the demonstration of *the recoil effect of the neutrino* by photographing the beta decay of ^{6}He in a cloud chamber[10].

Among the most important recent results in the fields above it should be mentioned that *inner bremsstrahlung* (IB) in positron decay was first observed and examined here on the ^{11}C isotope[11]. The investigation of the IB spectrum of ^{32}P showed that discrepancies in previous works had been caused by the improper experimental arrangements. By using magnetic deflection for the beta-rays, it was possible to get rid of the external bremsstrahlung and obtain an agreement with theory in the energy range of the measurement[12].

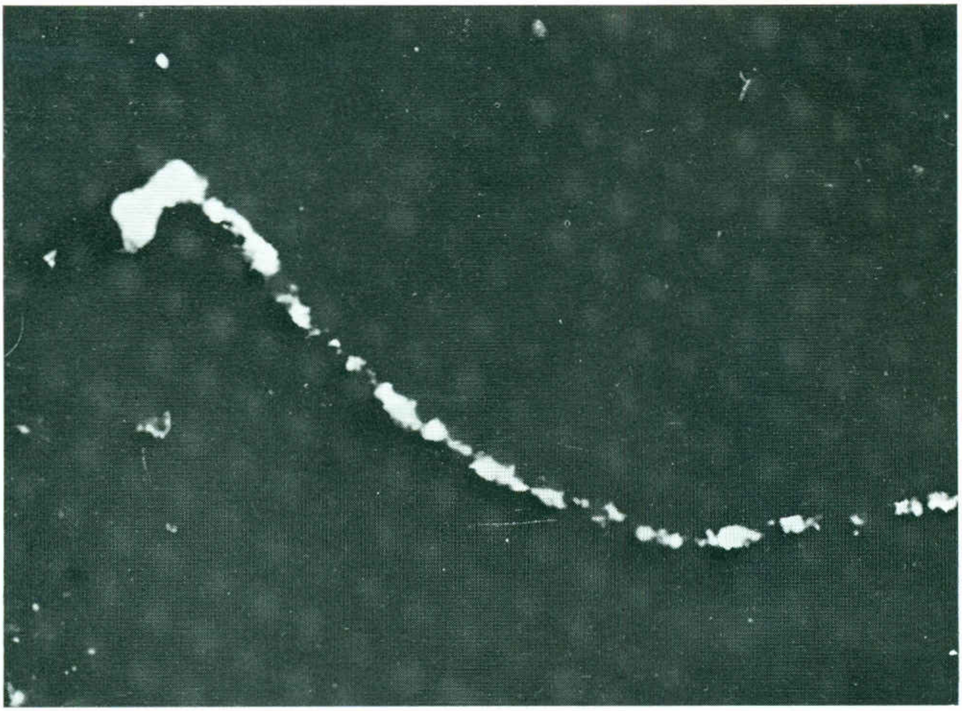
The investigation of *electron capture* (EC) and related phenomena began fifteen years ago with the determination of ratios of EC to positron emission in the radioactive decay of nuclei. E. Vatai has shown that the calculations of exchange and overlap corrections to the EC give a better agreement with experiment if the final-state vacancy created by the EC is taken into consideration[13]. Furthermore, the ratio of nuclear matrix elements can be determined from the

10 J. Csikai and A. Szalay, International Conference on Mesons and Recently Discovered Particles, Padova—Venezia 1957, Ciclografia Borghero, Padova, 1958, p. IV-8

11 D. Berényi, T. Scharbert and E. Vatai, Nucl. Phys. A124 (1969) 464

12 D. Berényi and D. Varga, Nucl. Phys. A138 (1969) 685

13 E. Vatai, Nucl. Phys. A156 (1970) 541



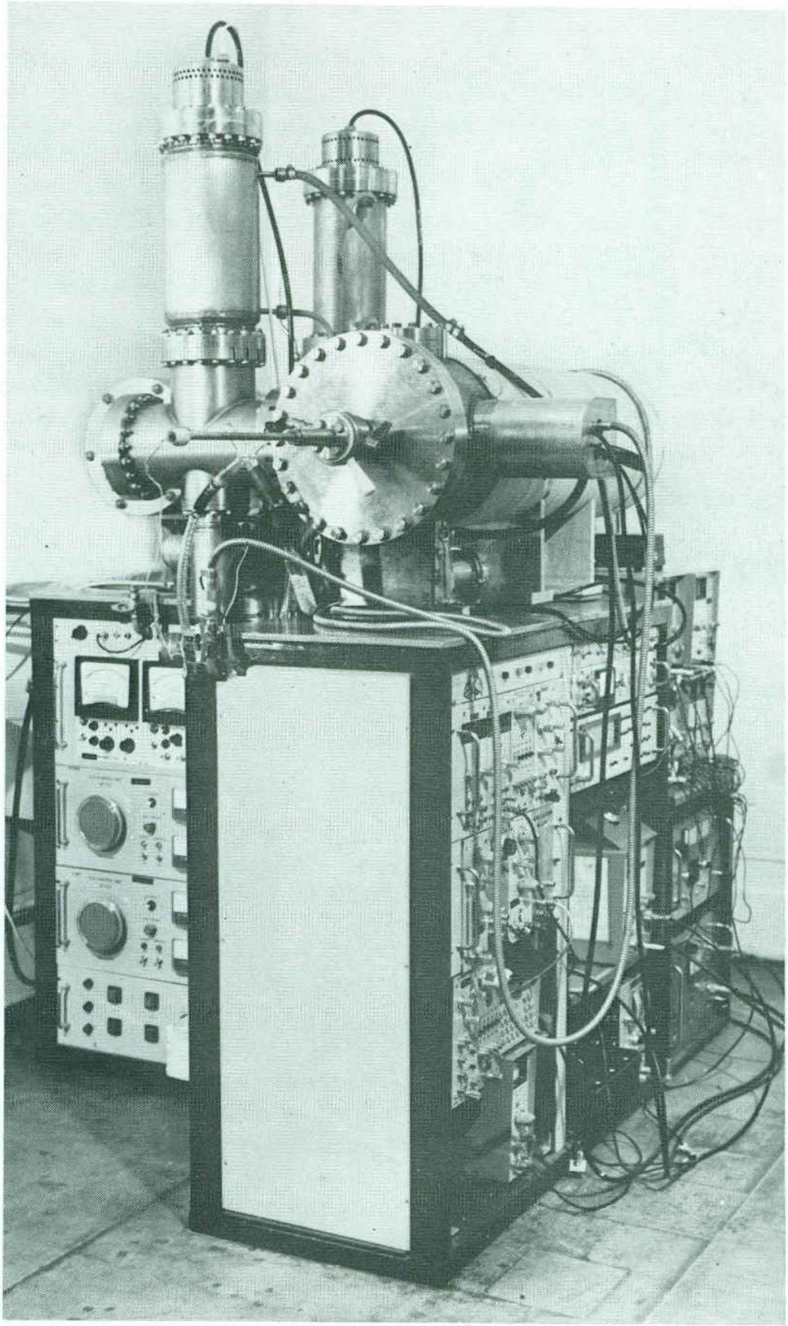
Recoil effect of the neutrino as seen in a cloud-chamber

L/K capture ratio for non-unique forbidden transitions[14]. It was also pointed out that the investigation of ft^+/ft^- ratios in the beta decay of mirror nuclei is not an unambiguous test of the existence of induced tensor interaction[15].

Ionization processes induced by electrons, positrons and heavy ions are important not only from the point of view of fundamental research, but also for dosimetry, radiation biology and material research. Investigations in this field were started with the study of *inner-shell ionization* by electrons and positrons. Experiments with positrons showed the equality of the cross-sections with electron impact ionization cross-sections and gave the first data for L-shell ionization by positrons[16]. These studies are extended now using electron, proton, alpha-particle and heavy-ion beams of accelerators in a relatively wide energy range.

A new field of research in the Institute is low-energy electron spectrometry based on a recently developed electrostatic electron spectrometer system, which offers a wide range of possibilities both in basic and applied research.

14 E. Vatai, Nucl. Phys. A212 (1973) 413
15 E. Vatai, Phys. Lett. 34B (1971) 395
16 S. A. H. Seif el Nasr, D. Berényi and Gy. Bibok, Z. Physik 271 (1974) 207



A low-energy electrostatic electron spectrometer developed in the Institute

Portable GM counter used in uranium prospecting

Geochemistry and microelement research

Research in *geochemistry* started with the discovery of uranium enrichment in some coals of Hungary in 1949. Prof. A. Szalay and his group recognized that in the geochemical circulation of natural waters it is the humic acids that retain a considerable portion of uranium and other high atomic-weight cations, due to ion exchange[17].

The further study of this topic led to results important for the *agricultural* cultivation of hundreds of millions of hectares in the world. The cation exchange retention by humic acids often results in the micronutrient starvation of plants on peat soils although these elements are present in the soil in sufficient quantities. The experiments have shown that dilute solutions sprayed on the leaves brought about a remarkable increase of the yield and also an improvement of quality.

Current research in this field involves the study of micronutrient-deficient areas of Hungary and microelements in domestic animals. The study of microelements in the whole food cycle including humans extends this work into the field of *biomedical research.*

17 A. Szalay, Acta Phys. Hung. 8 (1957) 25

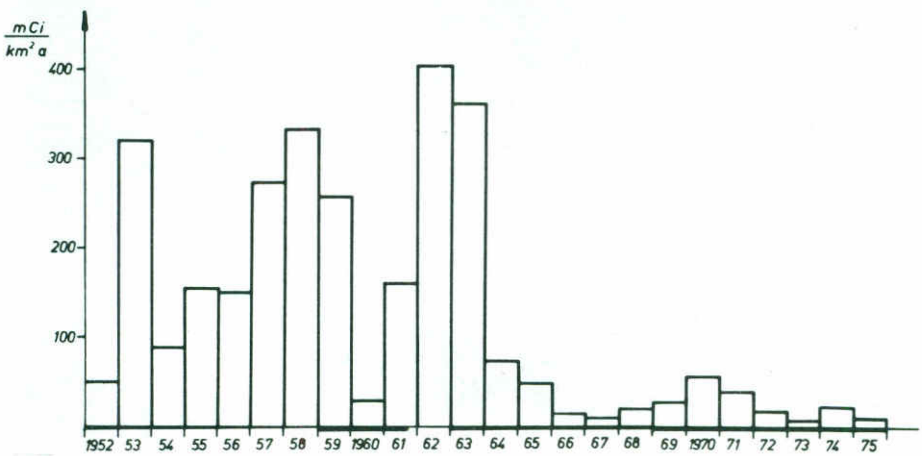
Geochronology

Radiometric dating is carried out by applying the Rb–Sr and K–Ar methods. Rb–Sr dating projects are running on igneous and metamorphic rocks, whereas the K–Ar method is applied mainly in dating volcanic rocks of Hungary. The argon extraction and purification system and the mass-spectrometer used for K–Ar dating were developed in this Institute, while the Rb–Sr dating work is done with Soviet-made mass-spectrometers of MI 1305 and MI 1309 type.

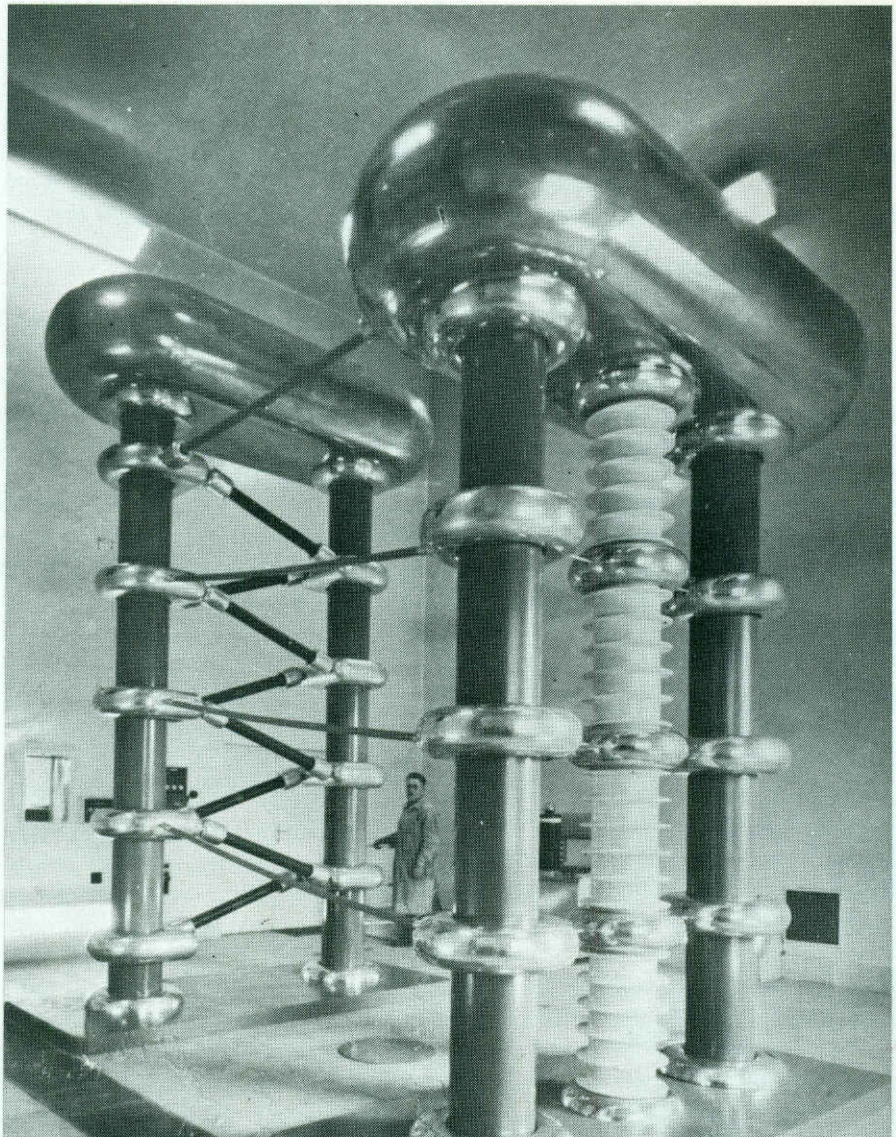
Environmental research

The work in this field started in 1952 with studies on *atmospheric radioactivity*. Since then regular measurements have been made on the total beta radioactivity of the precipitation due to fission products released in atmospheric nuclear weapon tests. The histogram on the total annual activities between 1952 and 1975 shows a marked decrease of contamination due to the nuclear test ban agreement.

Since 1966 the investigations have been extended to the systematic measurement of ^{85}Kr pollution in the atmosphere. This pollution, arising from the reprocessing of burnt uranium fuel rods of nuclear industry, is gradually increasing although at present it is well under the dangerous level.



Radioactivity of fission products from atmospheric weapon tests measured in the precipitation in Debrecen



Cockcroft–Walton generator built in the Institute in 1960–62

Research and development in methods and experimental techniques

From the very beginning a considerable amount of work has had to be devoted to developing equipments needed in research.

One of the first home-made instruments was a portable Geiger-Müller counter used by A. Szalay and his collaborators while discovering the uranium enrichment in some coals.

Among the constructions in the early years, a toroid-sector beta-spectrometer based on an original principle[18] and a permanent-magnet band beta-spectrograph of high resolution with a working radius of 75 cm should be mentioned.

Accelerators

All of our accelerators, the two Van de Graaff generators (VdG–5 and VdG–1), the Cockcroft–Walton generator and the neutron generator are home-made. The principles adopted in the construction of the VdG's constitute an advance in the *physics of accelerators*. The most remarkable among them are the choice of the proper electrode configuration to attain an optimum field uniformity near the high-voltage terminal[19] and the method of decreasing the amplitude of voltage surges following breakdowns[20]. The first electron-optical description and a detailed treatment of the aberrations of a new focussing and beam steering element, the so-called asymmetrized quadrupole lens, were given by our scientists[21].

The accelerating voltage of the VdG–1 is 0.3–1.5 MV. It is used for protons, alpha particles and light ions, with about 1 μA beam intensity and 1 keV energy resolution. The accelerating voltage of the VdG–5 is 0.8–5 MV. The intensity of the proton or alpha-particle beam is about 1–10 μA with an energy resolution of 1 keV. The energy is measured with a proton resonance magnetic field meter at the deflection magnet. At the VdG–5 five experimental channels are available. The data acquisition and processing are based on a Nuclear Data 50/50 system.

The accelerating voltage of the *Cockcroft–Walton generator* is 100–700 kV. Proton, deuteron and electron beams can be produced with an intensity of 10 μA–1 mA and 800 eV energy resolution for positive ions.

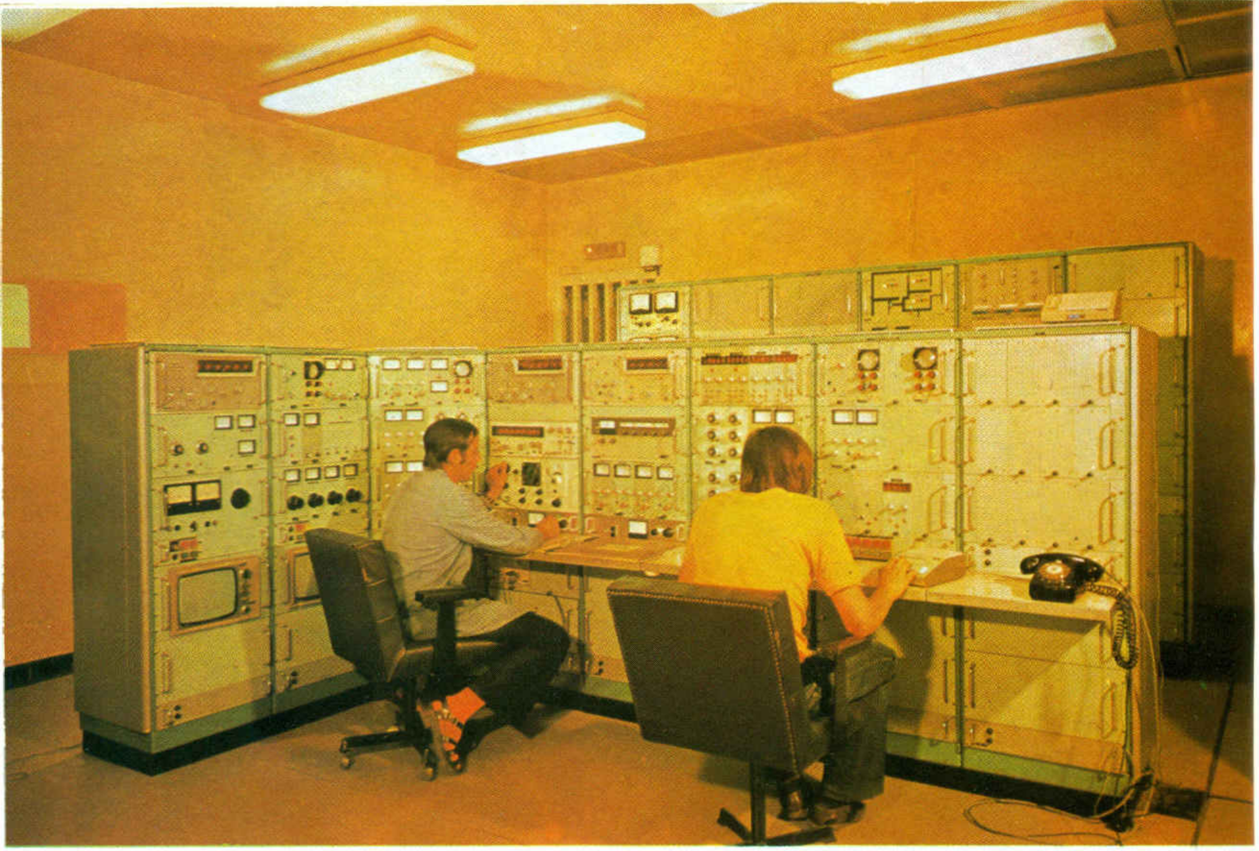
The 150 kV *neutron generator* used to produce 14 MeV (T + d) neutrons with a yield up to 10^{10} n/s. This generator is now under reconstruction to increase its neutron yield. The generator is equipped with a fast pneumatic transport system.

18 J. I. Horváth, Experientia 5 (1949) 112; A. Szalay and D. Berényi, Acta Phys. Hung. 10 (1959) 57; D. Berényi, Nucl. Instr. Meth. 23 (1963) 125

19 Á. Kiss, E. Koltay and A. Szalay, Nucl. Instr. Meth. 46 (1967) 130

20 Á. Kiss, Nucl. Instr. Meth. 92 (1971) 361

21 E. Koltay and Gy. Szabó, Nucl. Instr. Meth. 35 (1965) 88; Gy. Szabó, ibid. 125 (1975) 339



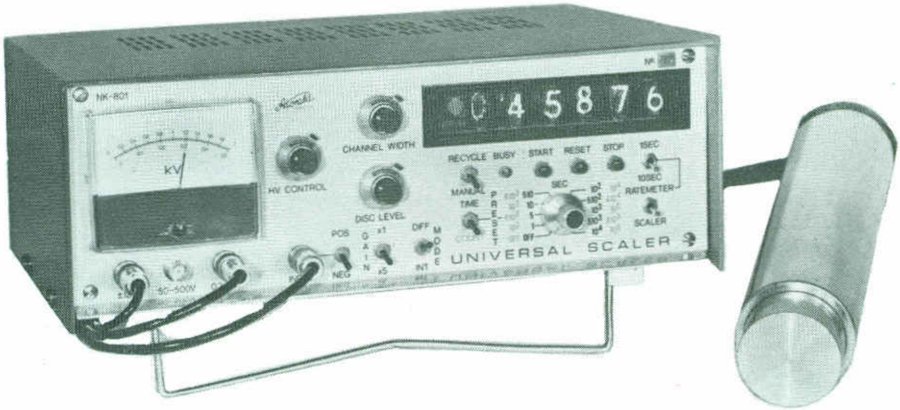
Control desk of the 5 MV Van de Graaff generator

Nuclear electronics

The nuclear electronic units of modular construction developed in the electronic department are suitable for processing signals of nuclear detectors of several types. Most of the units controlling the accelerators have been constructed here.

A method of eliminating pile-up pulses was first developed in the ATOMKI using the so-called zero-crossing pulse-shape discrimination[22]. This technique is suitable also for particle identification[23]. Some improvements in the spectroscopic parameters of the electronic units have been patented.

22 Gy. Máthé, Nucl. Instr. Meth. 23 (1963) 261
23 Gy. Máthé and B. Schlenk, Nucl. Instr. Meth. 27 (1964) 10



An ATOMKI electronic instrument

Detection techniques

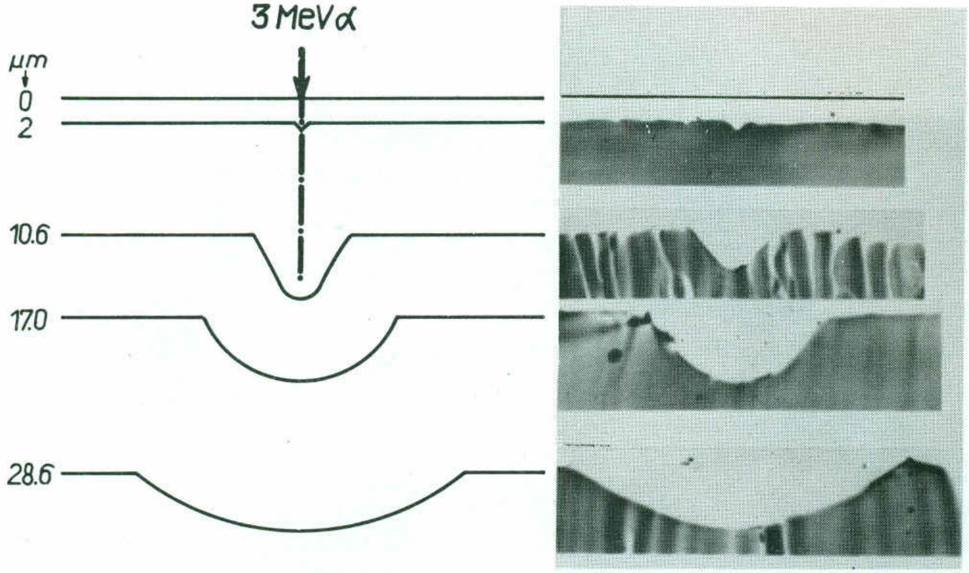
Radiation detectors have been constructed in the Institute since its foundation.

A notable result in the improvement of alkalihalide *scintillators* was the increasing of their light yield with reflective coating on their surface[24].

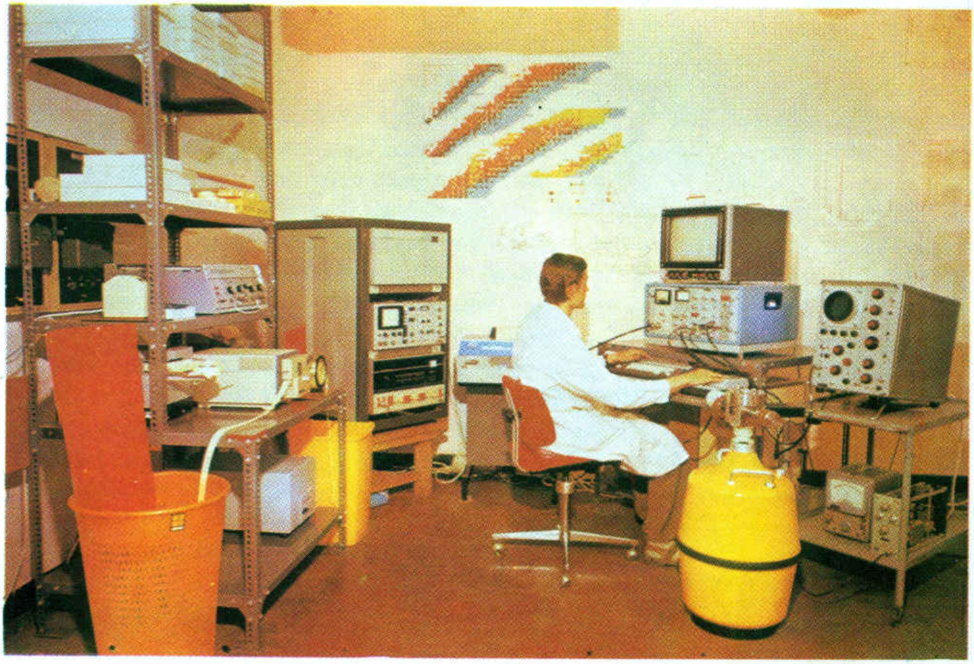
Photoemulsion technique, traditional in this Institute, was applied e. g. in measuring the energy spectrum of the Po + Be neutron source[25]. In the last decade a number of results have been achieved in the development and application of the *solid-state track detector* technique. The finding that plastic track detectors can be used in fast neutron flux measurements[26] and the description of the track-etching kinetics[27] are the most remarkable among them. Recent experiments on visualizing the tracks with methods other than the traditional etching are very promising. The new method for the energy discrimination of alpha particles based on the relation between the energy and track diameter[28] has been applied in (d, α), (^{3}He, α) and (p, α) measurements.

To meet the requirements of nuclear spectroscopy and X-ray fluorescence analysis, *Si(Li) and surface-barrier detectors* are made in the Institute. Si(Li) detectors are used in home-made X-ray emission analyzers. These equipments make possible the simultaneous and rapid determination of the concentration of the elements with $Z > 11$. The smallest detectable concentration is about 1 ppm or less.

24 Gy. Máthé and R. Voszka, Nucl. Instr. Meth. 16 (1962) 335
25 L. Medveczky, Acta Phys. Hung. 6 (1956) 261
26 L. Medveczky and G. Somogyi, Proc. VI. Int. Conf. on Corpuscular Photography, Florence, CEPI Roma, 1967, p. 461
27 E. g.: G. Somogyi and A. S. Szalay, Nucl. Instr. Meth. 109 (1973) 211
28 G. Somogyi, Nucl. Instr. Meth. 42 (1966) 312

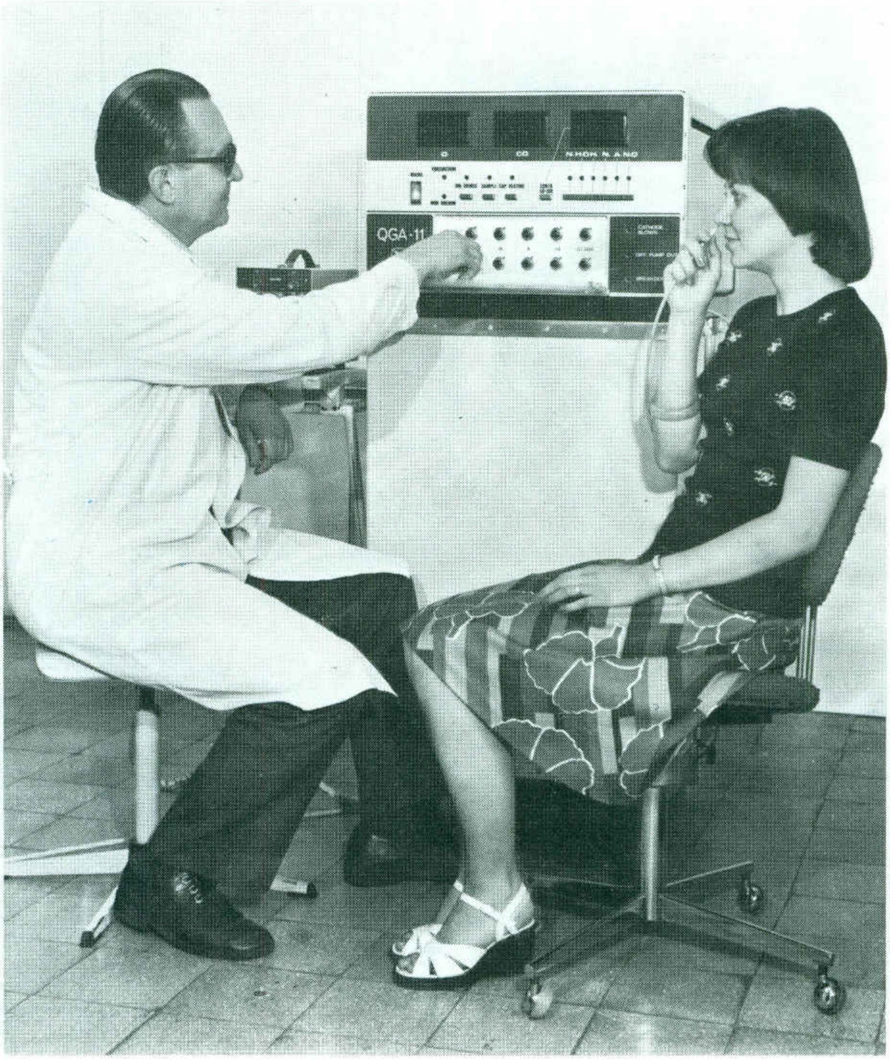


Calculated shapes and electron micrographs of an etch-pit profile in a polycarbonate track detector at increasing values of the surface removal

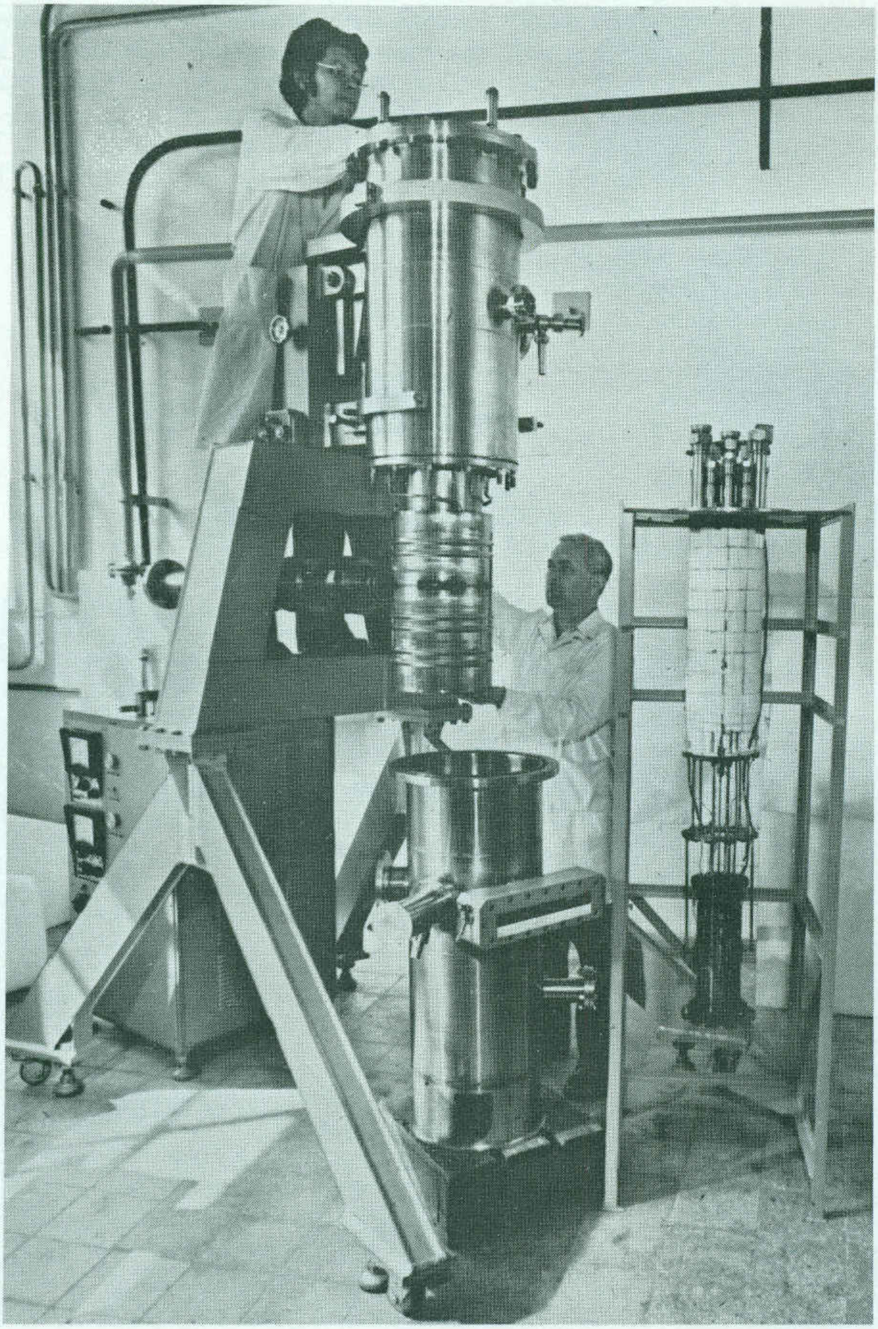


The X-ray fluorescence laboratory

In the low-energy electrostatic electron spectrometer *(ESCA equipment)*, constructed lately in the Institute, the investigated sample is excited by soft X-ray, and the energy of the emitted photoelectrons is measured. This spectrometer can be used not only for analysing atomic electrons, but also for beta-ray spectroscopy up to 25 keV beta energy with a resolution of 10^{-2}–10^{-3}. The measurements are controlled and the measured data are processed by a TPAi computer and a CAMAC system.



Quadrupole mass spectrometer as medical gas analyzer



Si(Li) electron spectrometer with superconducting magnet transporters for in-beam nuclear spectroscopy

Vacuum technique and cryogenics

The vacuum technical group has developed oil diffusion pumps of various pumping speeds and also an orbitron-type ion-getter pump to eliminate hydrocarbon contaminants. For the analysis of the residual gases of vacuum a quadrupole mass spectrometer has been constructed.

The cryogenics group is engaged in developing cryostats, and the cryotechnical design of a *superconductive magnetic electron spectrometer* to be used at the VdG–5 has also been elaborated by them. The equipment is now under test.

Technical background

In the work of development the role of the well-skilled staff of the Technical Department (about forty people) and the Department of Nuclear Electronics (about thirty members) is very important.

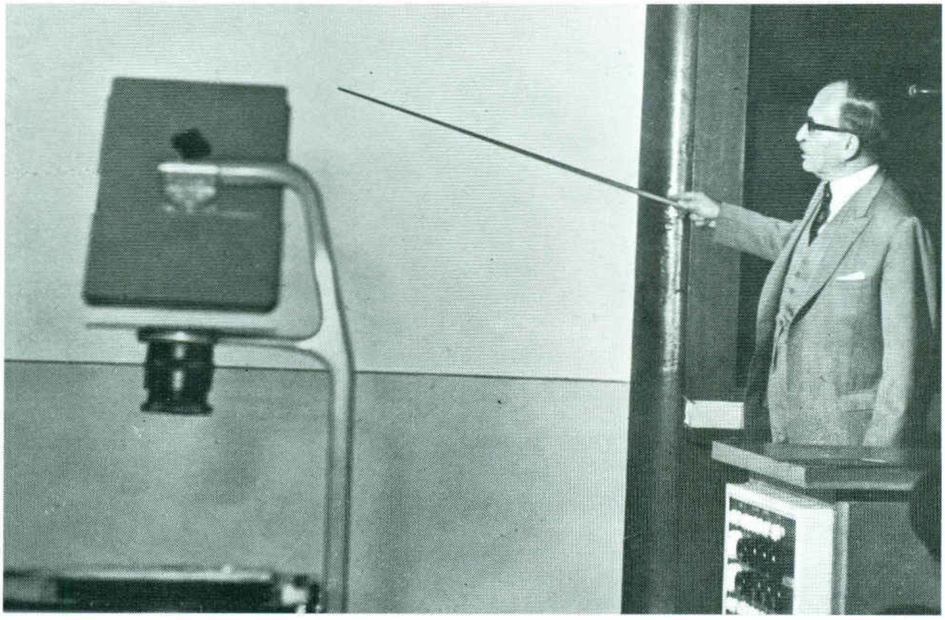
The research work is backed by a small *computation* group. The Institute has a PDP 11/40 computer and access to a CDC 3300 in Budapest via a UT 200 user terminal.

UT 200 remote station of the CDC 3300 computer

External connections, cooperation

The ATOMKI lays stress upon relations to other laboratories, scientific and social organizations and the social and economic life of this country.

From among the home institutions, the Central Research Institute for Physics, Budapest, the Institute for Experimental Physics, Kossuth University, Debrecen and the University of Medicine, Debrecen have been the most frequent partners. Numerous joint works have been done in collaboration with the Joint Institute for Nuclear Research, Dubna, the Nuclear Physics Laboratory, Oxford, the Yoffe Institute, Leningrad, the Physics Laboratory, University of Utrecht, the Institute of Chemical Research, Kyoto University, etc. The Institute acknowledges the most valuable aid of the institutes which have received its members, and visiting scientists are always welcome in ATOMKI.

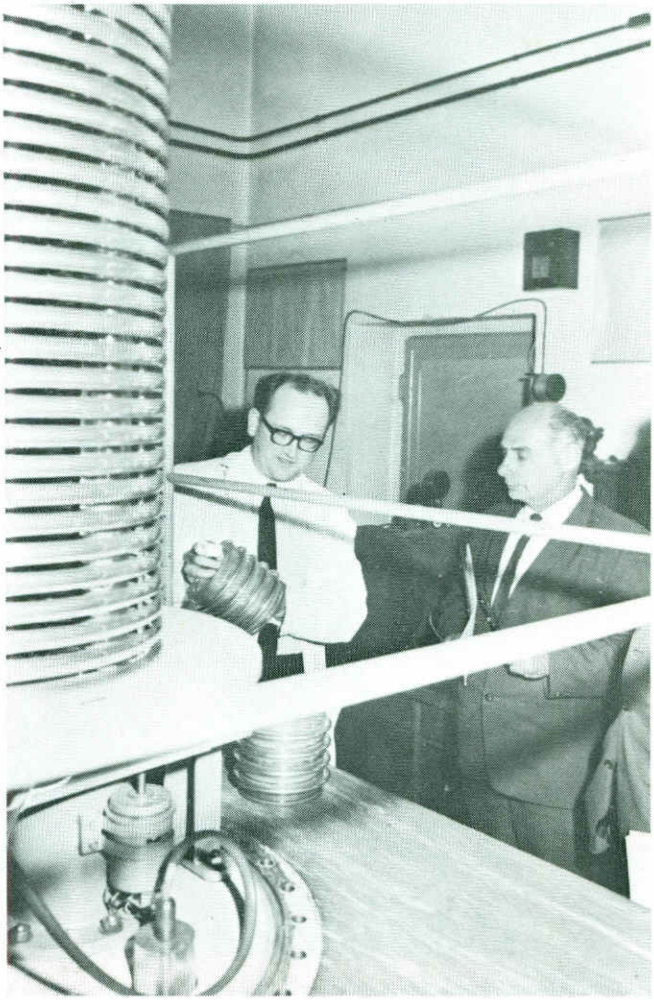


Nobel-prize laureate D. Gabor lecturing in the ATOMKI

Several scientific meetings have been organized by the ATOMKI. The most significant among them was the International Conference on Electron Capture and Higher Order Processes in Nuclear Decays in 1968.

A number of international boards have members from the ATOMKI, e. g. the International Nuclear Data Committee (IAEA), the Editorial Board of the periodical Nuclear Data, the Scientific Council and topical committees of the Joint Institute for Nuclear Research, Dubna. Prof. Szalay is a doctor honoris causa of the Marie Skłodowska-Curie University of Lublin. Leading scientists of the ATOMKI participate in various scientific commissions of the Hungarian Academy of Sciences, the Roland Eötvös Physical Society of Hungary, the National Atomic Energy Commission of Hungary, etc.

Academician G. N. Flerov visiting the ATOMKI



The ATOMKI pursues training activity in several forms. Members of the staff give special courses at the Kossuth University, act as supervisors in diploma works of undergraduates, and the Institute grants fellowships to postgraduates. Furthermore, a modest fellowship is offered to school-teachers who join in research work. Moreover, a great number of scientists from developing countries have studied and obtained scientific degrees here. The ATOMKI is open to academic people interested in research related to that of the Institute. They have the possibility to join as research guests, use the library, computers, etc.

President of the Hungarian Academy of Sciences T. Erdey-Grúz (left) in the Institute

Secretary General of the Hungarian Academy of Sciences F. Márta (left) visting the Institute

The visit of the directorate of the Central Research Institute for Physics (Budapest) in the ATOMKI

Practical application of the scientific results

At the present state of the development of science and technology it is of particular importance to maintain a direct connection between pure scientific research and application. An institute engaged in basic research has to seek for findig the ways of utilization of the methods developed and putting them into practice. ATOMKI is qualified to promote the adaptation of nuclear methods in other fields of science and production by the tradition of interdisciplinary research and by the compelling need of constructing a major part of its own equipment.

A review of applied research in this Institute was given in a previous section. We only mention the important role of ATOMKI in introducing radioisotopes into medical biology and clinical practice in this country. Here we single out only a few examples of the numerous applications of prospective utility for society and national economy.

First of all, Prof. Szalay and collaborators' work is worth mentioning because it is an apt example for the interrelation of pure and applied sciences from the pre-history of the Institute to the present. The discovery of uranium deposits in Hungary was followed by the understanding of the sorption of some microelements in fossile materials. The same mechanism has been recognized to cause the starvation of plants on peat soil, and methods have been worked out against it.

A family of basic *nuclear electronic* instruments, originally designed for internal use, have recently found a good market both in this country and abroad. E. g. the laboratory of the first nuclear power plant in Czechoslovakia is partly equipped with ATOMKI instruments. The production has been gradually increasing: a further extension through the participation of an industrial firm is in preparation.

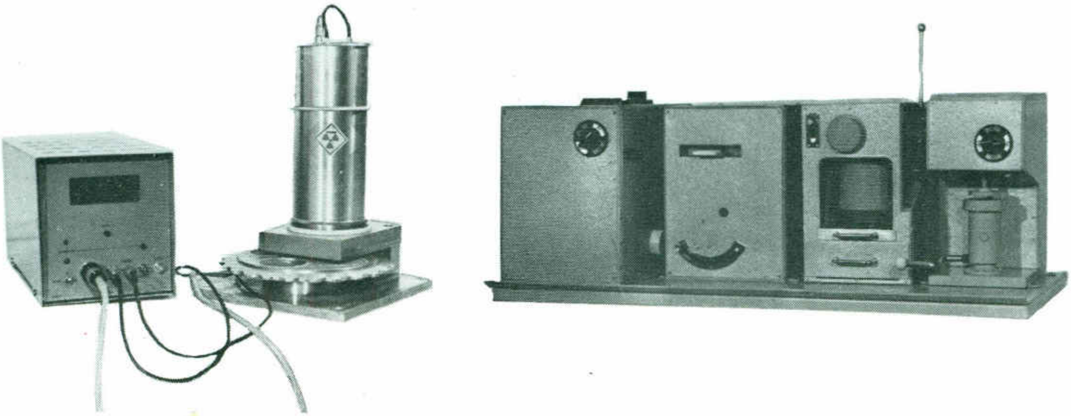
A most profitable application of nuclear techniques lies in *chemical analysis and the testing of materials.*

A small quadrupole mass spectrometer designed for the analysis of residual gases of vacuum has proved suitable to the analysis of the exhaled air. Now it is produced by the Medicor Works as a medical equipment.

X-ray fluorescence spectroscopy provides another tool that has been adapted by this Institute to special problems in industrial production, e. g. the fast determination of the calcium concentration in bauxite. It shows much promise for further applications e. g. in raw material research, food testing and metal industry. Analyses are performed for external customers and apparatuses for their special objects are being constructed.

The versatile method of electron spectroscopy has been adapted to chemical analysis and spectrometers have been built and are under construction. This technique is very useful in examining the chemical structure of thin surface layers, metallic alloys and complicated chemical compounds and it is expected to find applications in a wide area from metal to pharmaceutical industry.

The work on the ^{85}K contamination of the air is pursued now according to a COMECON commission to co-ordinate this branch of radiation research.



Instrument for the rapid determination of the calcium content of bauxite

Organization of the scientific and technical staff

Director: Prof. D. Berényi, Corr. Member of the Hung. Academy of Sciences
Scientific deputy director: Dr. B. Schlenk, CSc

Scientifitic and technical divisions:

1. Department of Nuclear Methods and their Interdisciplinary Applications
   Head: Dr. G. Somogyi, CSc
2. Department of Nuclear Spectroscopy
   Head: Dr. T. Fényes, DSc
3. Department of Electrostatic Accelerators
   Head: Prof. E. Koltay, DSc
4. Department of Nuclear Electronics
   Head: Dr. Gy. Máthé, CSc
5. Nuclear Atomic Physics Group
   Head: Prof. D. Berényi, Corr. Member of the Hung. Academy of Sciences
6. Group of Theoretical Nuclear Physics and Computation
   Head: Dr. B. Gyarmati, CSc
7. Group of Interdisciplinary Research
   Head: Prof. A. Szalay, Member of the Hung. Academy of Sciences
8. Group for Scientific Documentation
   Head: Dr. L. Medveczky, CSc
9. Technical Department
   Head: I. Dombi, chief engineer

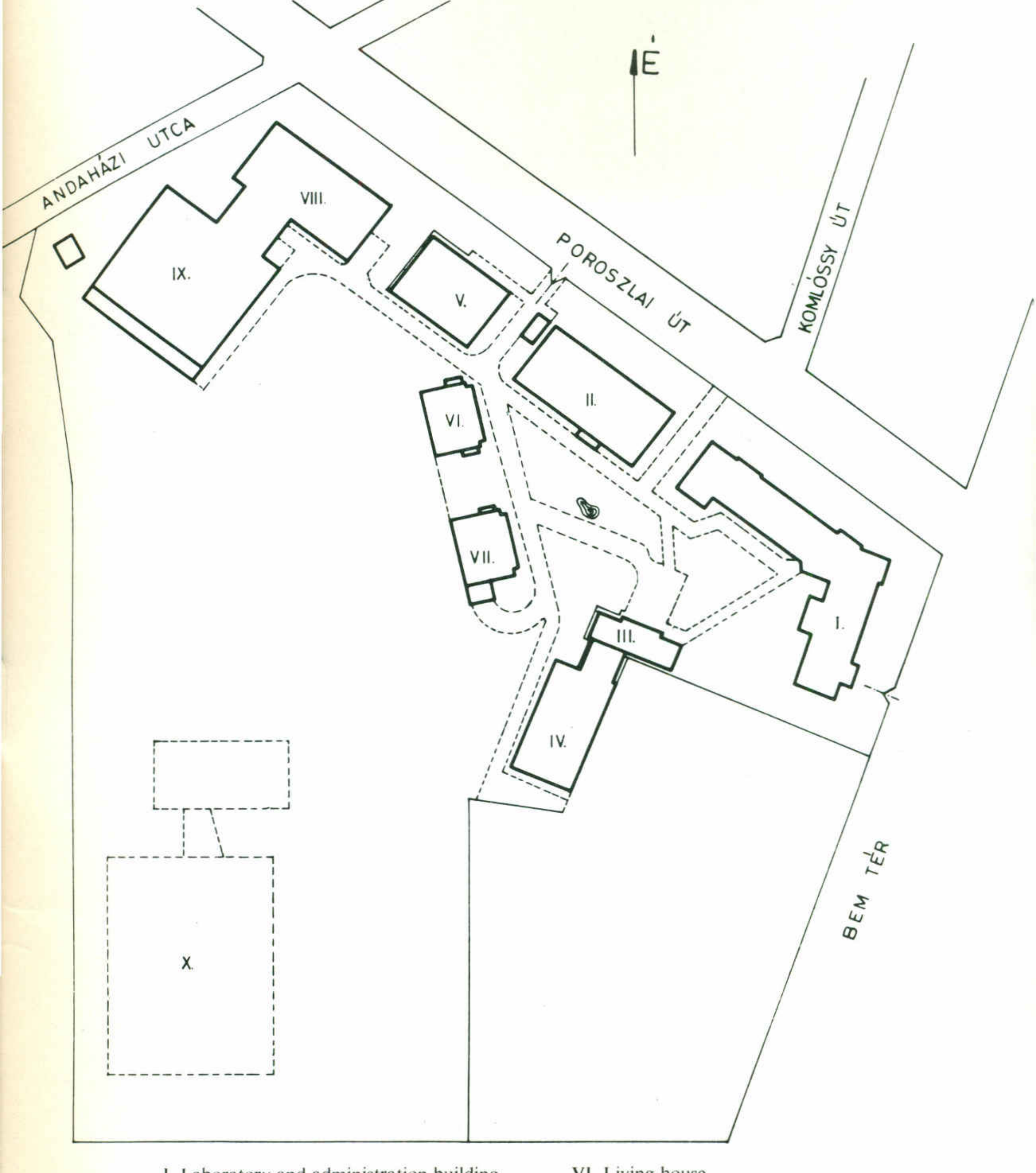
General information

Address: H–4026 Debrecen, II., Bem tér 18/c
Postal address: H–4001 Debrecen, Pf. 51.
Cable: ATOMKI Debrecen
Telex: 72–210
Telephone: (52) 15–675
Founded: July 1, 1954
Staff: more than 200 permanent staff members (about 65 research workers), plus visiting scientists, students
ATOMKI BULLETIN: The Institute issues the quarterly ATOMKI Közlemények (ATOMKI Bulletin). The languages of publication are Hungarian, English and Russian. Please contact the library for additional information.

The library

Felelős kiadó: dr. Berényi Dénes, az ATOMKI igazgatója
Szerkesztette: dr. Medveczky László és dr. Lovas Rezső
A kézirat nyomdába adásának ideje: 1976. július
76.3484.66-42 Alföldi Nyomda, Debrecen

Lay-out of the buildings of the ATOMKI



I. Laboratory and administration building
II. Laboratory building
III. Garage
IV. Cryogenic laboratory
V. Residential building (guest-rooms)
VI. Living house
VII. Living house
VIII. Laboratory building and library
IX. Accelerators
X. Technical department (projected)