THE NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

FOURTH ANNUAL REPORT

1960—1961

RUTHERFORD HIGH ENERGY LABORATORY
HARWELL, DIDCOT, BERKSHIRE

THE NATIONAL INSTITUTE
FOR RESEARCH IN NUCLEAR SCIENCE

Fourth Annual Report

for the period 1st April, 1960
to 31st March, 1961

Presented to the United Kingdom Atomic Energy Authority
in pursuance of Article 13 of the Institute's Royal Charter

RUTHERFORD HIGH ENERGY LABORATORY
HARWELL, DIDCOT, BERKSHIRE

Sir,

I have the honour to submit, in accordance with Article 13 of the Institute's Royal Charter, the Fourth Annual Report of the National Institute for Research in Nuclear Science. This Report covers the period from 1st April, 1960, to 31st March, 1961.

I have the honour to be, Sir,
Your obedient Servant,

Bridges

Chairman, National Institute for Research in Nuclear Science.

Chairman,
United Kingdom Atomic Energy Authority,
11 Charles II Street,
LONDON, S.W.1.

CONTENTS

THE NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

FOURTH ANNUAL REPORT

for the year ending 31st March, 1961

INTRODUCTION

1. The following changes were made in the membership of the Institute during the year. Sir James Mountford and Professor N. F. Mott retired and were succeeded as university members by Sir John Wolfenden and Professor J. M. Cassels. Professor P. I. Dee succeeded Professor P. M. S. Blackett as one of the two members representing the Department of Scientific and Industrial Research, and Dr. J. B. Adams succeeded Sir Basil Schonland as one of the representatives of the United Kingdom Atomic Energy Authority. The full membership is given in Appendix II.

2. The Institute have found it necessary to adopt a formal seal. The design chosen is shown on the front cover of the report.

ACCOUNTS

3. A Treasury direction on the form in which the accounts of the Institute shall be prepared has been made during the year, and the accounts for the period to 31st March, 1960, and for the year ended 31st March, 1961, are included in Appendix I. It may be of interest to list the major items included in the transfer of assets from the U.K.A.E.A. at a total of £1,000,190 as stated in the capital account. These are, (a) the proton linear accelerator and its associated buildings, (b) other land and buildings, including the Rutherford Laboratory site, and (c) miscellaneous plant items.

4. The Institute's estimates for 1961/62 were submitted to the U.K.A.E.A. at a total of £6,211,000.

THE RUTHERFORD HIGH ENERGY LABORATORY

5. Good progress has been made with the development of the Rutherford Laboratory during the year. Work has principally centred round the two accelerators, the 50 MeV proton linear accelerator, which successfully completed its first year's operation as an instrument for nuclear research, and Nimrod, the 7 GeV proton synchrotron still under construction and due for completion in 1962. A major event during the year was the transfer of the bulk of the staff at the Laboratory from the employment of the United Kingdom Atomic Energy Authority to that of the Institute. The growing interest in the work of the Laboratory developing in the various university centres of nuclear research was reflected in the many visits by university staff to the Laboratory and their discussions with Institute staff concerning proposed research programmes by university teams using the Laboratory's accelerators. In the case of the proton linear accelerator such research is of course already under way.

6. Extensive building work has continued at the Laboratory. A new prefabricated office block has been built and occupied, and a large extension to the

main laboratory and office block is rapidly nearing completion. Work has started on a low-activity radiochemical laboratory required for university visitors using the Laboratory's accelerators and also those doing research using the A.E.R.E. reactors under the sponsorship of the Institute. Detailed plans have been prepared for a new laboratory required for development and testing of nuclear equipment to be used with Nimrod, and general accelerator research. It is hoped to start work on this, and also a restaurant for the Laboratory, later in 1961. Despite these developments, the rapid growth in the number of staff at the Laboratory—intensified as a consequence of the decision that the Institute should become less dependent on the services of the A.E.R.E.—has meant that the accommodation problem has not been appreciably lessened. Consequently, further proposals have been made for an additional three-storey laboratory and office block to meet future needs.

7. The Laboratory is rapidly becoming more independent of its neighbouring establishment, the A.E.R.E., as more engineering and administrative services, originally supplied by them are being taken over by the Laboratory's staff. For example, most of the administrative work connected with the recruitment and employment of staff is now carried out within the Laboratory instead of, as formerly, by the A.E.R.E. Personnel Branch. The A.E.R.E. Labour Relation Branch continued to give assistance, however, in the field of labour recruitment and labour relations. The local finance and accounting functions have largely been taken over and it is planned that the transfer should be complete by March, 1962. There has also been a large increase in the engineering services available within the Laboratory. Among the many services still provided by the A.E.R.E. are stores, medical service, canteen and hostel catering, fire service, grounds, bus transport (but no longer other forms of transport), photographic etc.

8. Arrangements have been made with the A.E.R.E. whereby long-term research and development in the field of electronic instrumentation, in support of the Laboratory's nuclear research programme, will be carried out by the A.E.R.E. Electronics Division who already have wide experience in this field.

9. The Institute have continued to provide financial support in aid of university research carried out either in connection with a particular experiment planned on the proton linear accelerator, or for the development of improved equipment for nuclear research at the Rutherford Laboratory, including Cerenkov chambers, spark chambers and a liquid helium bubble chamber.

10. Notable events during the year were the visits to the Rutherford Laboratory by Her Majesty Queen Frederika of The Hellenes in November, 1960, and two parties of members of the Royal Society and their guests on the occasion of the Society's Tercentenary celebrations in July, 1960.

11. An international conference on high energy physics was held in Rochester, U.S.A., in September, 1960; 14 university scientists from the United Kingdom were invited and as in the case of the similar conference in the previous year, the cost of their travel and subsistence was shared between the Royal Society and the Institute, but it is expected that in future years the Royal Society will be able to resume full responsibility for the support of such visits.

STAFF

12. The principal event of the year has been the taking over of responsibility from the Atomic Energy Authority for staffing the Rutherford Laboratory. This was previously planned to occur only after the completion of Nimrod (see Third Annual Report, para. 12), but in order to facilitate a smooth and gradual transfer from work on Nimrod design to work on nuclear equipment and other Institute tasks, it has been decided not to wait until then. Accordingly since January, 1961, the Rutherford Laboratory has had its own staff of scientists, engineers, administrators and industrial employees; the numbers in post at 31st March, 1961, were 531 in all. Many of these came from the Accelerator and Engineering Divisions of the A.E.R.E. by transfer, negotiated in principle by the Institute with representatives of the staff and the A.E.R.E., but individually offered and accepted in each case, and of the 287 offers made all but 17 were accepted.

13. Progress has been made towards the setting up of a Whitley Council and Joint Industrial Negotiating and Consultative machinery for the Institute. The Staff Association's representatives of the Institute's Non-Industrial employees have been granted official recognition and on the Trade Union side, draft constitutions for a Rutherford Laboratory Joint Consultative Committee and a National Institute Joint Negotiating Committee have been agreed in principle. Pending the formal establishment of the Consultative body, informal meetings have been held from time to time between representatives of the Institute and representatives of the Trade Unions.

HOUSING AND HOSTELS

14. The A.E.R.E. have provided 10 Authority houses for N.I.R.N.S. visitors and have undertaken to provide 20 houses for new Institute staff. 115 of the staff transferred from A.E.R.E. to the Institute continue to occupy A.E.R.E. houses. The Institute are buying 26 houses and proposals for building houses at Didcot and Abingdon are being considered, although the original proposal for 48 houses in Abingdon mentioned in the last report (paragraph 16) has had to be abandoned. Arrangements have been made with the Borough of Abingdon for a number of local authority houses to be made available for tenants nominated by the Institute. The Cosener's House is now in use as a guest house, primarily for university visitors. Hostel accommodation for Institute staff is being provided by the A.E.R.E.

RESEARCH REACTORS

15. The Research Reactor Committee of the Institute have given further detailed consideration to the requirements of universities for nuclear reactors for training and research purposes. On the basis of the committee's work the Institute made recommendations to the D.S.I.R. and other Government Departments involved, concerning the various university proposals.

THE PROTON LINEAR ACCELERATOR

16. The completion of the 50 MeV proton linear accelerator was reported in the third annual report. Nuclear research was started on the 20th April, 1960, and in the first year of operation a total of 2,105 hours of experimental time has been made available to research workers from many institutions. In February, 1961, greater utilization of the machine was achieved by extending the period of operation to 16 hours per day and by the end of 1961 it is expected that it will be possible to operate a full 24 hour per day schedule.

17. About 50 research workers are actively engaged in nuclear research on the accelerator, the great majority of these coming from the universities. The universities principally concerned are Birmingham, Exeter, Glasgow, Oxford and London (King's College, Queen Mary College, University College and Westfield College). Because of the great enthusiasm and keenness to use the Laboratory's resources, which have been displayed by university staff, the demand for experimental time at present exceeds that which can be provided. The situation will be eased when 24 hours per day working is possible by which time it is expected that teams from Manchester University and The Queen's University, Belfast, will also be actively engaged in research.

18. Until recently there were few accelerators that could provide experimental information in the energy range 10 to 50 MeV which is accessible to the proton linear accelerator. Because of this, the experimental work that is now being carried out covers a very wide field. It includes experiments aimed at investigating the basic interaction between nucleons, experiments which study the gross behaviour of nuclear matter and which test the validity of various nuclear models and finally those which yield information on the details of nuclear structure. The characteristics of high proton current, good energy resolution and low background have demonstrated that the proton linear accelerator is a very powerful tool for nuclear research. Experiments are proving to be possible with it which, up to the present, have been beyond the scope of other accelerators.

19. The most important achievement during the year has been the installation and successful testing of the polarized proton source. (A polarized beam of protons is one in which the protons are spinning predominantly in a fixed direction relative to their direction of motion). Nuclear forces are known to be spin dependent and it is for this reason that it is desirable to be able to do experiments with particle beams in which the spin direction has been defined. At higher energies polarized beams are usually produced by a nuclear scattering process. This is not a practicable method below about 100 MeV and so a new approach has been developed in which the protons are polarized at source and then accelerated. Considerable technical problems had to be overcome and the laboratory work and engineering altogether has taken over 3 years. The polarized source which is now installed has been found to behave in a very reliable and controllable fashion. The polarization and the proton current that can be obtained depend somewhat on the settings of the source controls but typical values are a polarization of 32% at a proton current of 5×10^7 per second. This is very close to the result that was expected from theoretical calculation and laboratory tests. The successful development of this source is of considerable importance as it will greatly extend the range of experiments that it is possible to do on the accelerator. Several laboratories are known to be working on similar projects but it is believed that this is the first source to be installed on an accelerator and to produce a beam of protons of sufficient intensity to be useful for nuclear experiments. The success of the project is due to efforts of scientists

and engineers in the P.L.A. Group who, at various stages, worked in collaboration with scientists from the Cavendish Laboratory, Cambridge, the Clarendon Laboratory, Oxford, and Birmingham University.

NIMROD

20. The 7 GeV proton synchrotron, Nimrod, at present under construction at the Laboratory should be available for the first experiments in 1963. Basically it consists of a large 155 ft. diameter ring-shaped electromagnet housed in a semi-underground circular building of reinforced concrete, 200 ft. in diameter. Protons accelerated to energies of 15 MeV in a preliminary linear accelerator known as the injector, enter into an annular gap in the magnet ring enclosed by a vacuum vessel, and proceed to revolve in circular orbits under the influence of the magnetic field. A radio-frequency accelerating unit increases the velocity of the protons on each orbit until they reach their maximum energy and are extracted to be used in experiments. During the acceleration, the magnetic field strength and the frequency of the electric accelerating field both have to be increased in a controlled manner to confine the proton orbits to the magnet ring, and so as to maintain the delicately balanced stability in the motion of the protons.

21. The final operation in the construction of the main building housing Nimrod has been completed during the year; this is the mounding of the magnet and injector rooms with a layer of earth some 20 ft. thick to provide adequate radiation shielding. Apart from this, building effort has largely been concentrated on the ancillary buildings associated with Nimrod, such as those housing the electric power generating plant and the building extensions required for the two large bubble chambers and associated plant. Detailed proposals have also been prepared for a considerable extension to the buildings housing the control area, i.e. control room and laboratories from which both the machine itself and the nuclear physics experiments to be carried out using it will be controlled. The extension will be designed to accommodate those concerned with the operation, maintenance and use of Nimrod, where it is essential for them to be located as near as possible to the machine.

22. The end of the year saw the injector in an advanced stage of construction. It is expected to produce the first 15 MeV beam during July, 1961*. In anticipation of this a local control room has been built and equipped to enable commissioning to proceed. Continuous measurement of the ion gun performance and beam characteristics has been carried out with satisfactory results. A major event during the year was the completion and installation of the liner, (the copper cylinder 44 ft. long and 5½ ft. diameter, in which electrical oscillations are excited for the purpose of accelerating protons down the axis). The radio-frequency equipment, needed to supply power to the liner was also largely completed. Tests have been carried out to measure the electrical characteristics of the liner and the results of these were very satisfactory. The series of hollow cylindrical electrodes known as drift tubes, which are to be spaced at intervals down the liner (and in between which the acceleration occurs) have been manufactured and some installed. The whole of the linear accelerator, with the exception of the drift tubes has been vacuum tested to a satisfactory pressure.

* See Supplement.

23. The last of the 336 20-ton steel sector blocks, comprising the 7,000 ton magnet yoke of the 155 ft. diameter ring-shaped electromagnet, was delivered early in the year, marking the successful completion of a major stage in construction. All the sectors have been accurately positioned round the ring and survey checks made periodically to ensure that they are remaining aligned within the very tight tolerances specified. The manufacture of the pole pieces—to be attached to the pole faces of the yoke to give the required 'shape' to the magnetic field—has proved a difficult technical problem, but after a lengthy development period required to prove the production processes devised, the first trial production pole pieces have recently been delivered. All the copper coils specially shaped to match the curvature of the magnet yoke have been manufactured and approximately one third of them installed on the magnet.

24. The radio frequency accelerator unit is the device which accelerates the protons in their orbital paths and consists basically of a resonant cavity continuously tuned by a variable inductance. Generally, work has progressed satisfactorily. Some difficulty has been experienced (as mentioned in para. 32 of the last report) in sticking together the ferrite blocks comprising the core of the variable inductance and therefore it has been decided to clamp the blocks together mechanically. A contract has been placed for the manufacture of the final version of the drive chain (equipment for generating the required radio-frequency). High-powered tests on the prototype cavity drive chain and bias supply have been completed, and the apparatus is now being installed in position in the Magnet Room for commissioning trials. The low-powered electronics including the frequency generator and timing circuit is being installed in the Control Room.

25. The large toroidal-shaped vacuum vessel in which the protons will travel is being made in a double-walled construction of epoxy resin reinforced with glass fibre cloth. A major stage in the construction programme was reached with the completion and delivery of the first prototype section of the outer vessel. This 50 ft. long section has been set up in a workshop specially equipped for vacuum testing and subjected to an extensive and thorough series of leak tests in which it has been pumped down and held at pressures much lower than it would be required to withstand in actual operation. This work has been of great value in proving the design and suggesting improvements in the manufacturing process, particularly relating to the need for maintaining high standards in the quality of the material at all stages. Meanwhile work on the other components of the vacuum system has proceeded satisfactorily.

26. The power plant required to supply current to the electromagnet consists basically of a motor-alternator set with flywheels for energy storage, converter equipment comprising 96 mercury arc rectifiers, and 8 phase splitting transformers. Good progress has been made during the year. The rotary plant has been completed and is undergoing tests at the manufacturers. The converter plant is also well advanced, with all the transformers and rectifiers delivered to the Laboratory and the majority of them installed. The buildings housing this equipment are nearly completed, and all of them made weathertight.

NUCLEAR EQUIPMENT

27. In addition to building the accelerator it is essential to provide the highly complex equipment needed to transport the accelerated beam of particles

(either protons or secondary particles produced by collision with internal targets) from within the accelerator to external targets (e.g. bubble chambers) where the experiments are to be carried out. Much theoretical and experimental work has been carried out on schemes and equipment for beam transport systems. Discussion groups and working parties have included potential users of Nimrod from the universities, the Atomic Energy Authority, and the Rutherford Laboratory, and the particular requirements of known experiments for high intensity and highly separated beams have been considered in detail.

28. The British National Hydrogen Bubble Chamber to be used with Nimrod is a joint venture by several British universities financed by the Department of Scientific and Industrial Research. For over a year a combined team of university physicists and technicians have been working with Rutherford Laboratory staff on the project, and assembly of component parts is well advanced. Apart from minor items the ancillary plant to be supplied by the Institute has arrived and is being installed.

29. Treasury approval has been obtained for the construction of the second large bubble chamber proposed for the Rutherford Laboratory, the Heavy Liquid Bubble Chamber. This work was started at University College London, and a strong design team has been formed there working in co-operation with a group at the Rutherford Laboratory, responsible for providing the necessary services. Although work is at a much earlier stage than with the Hydrogen Bubble Chamber, some component parts have already been ordered and the design of others continues at the College. The building to house the bubble chamber is well advanced.

Supplement to the Fourth Annual Report

To avoid holding up the Annual Report until the Institute accounts have been completed, it has been decided to make future reports for the academic year ending in September. In this way, the accounts will be published approximately six months after the end of the accounting year and the report itself will be up to date.

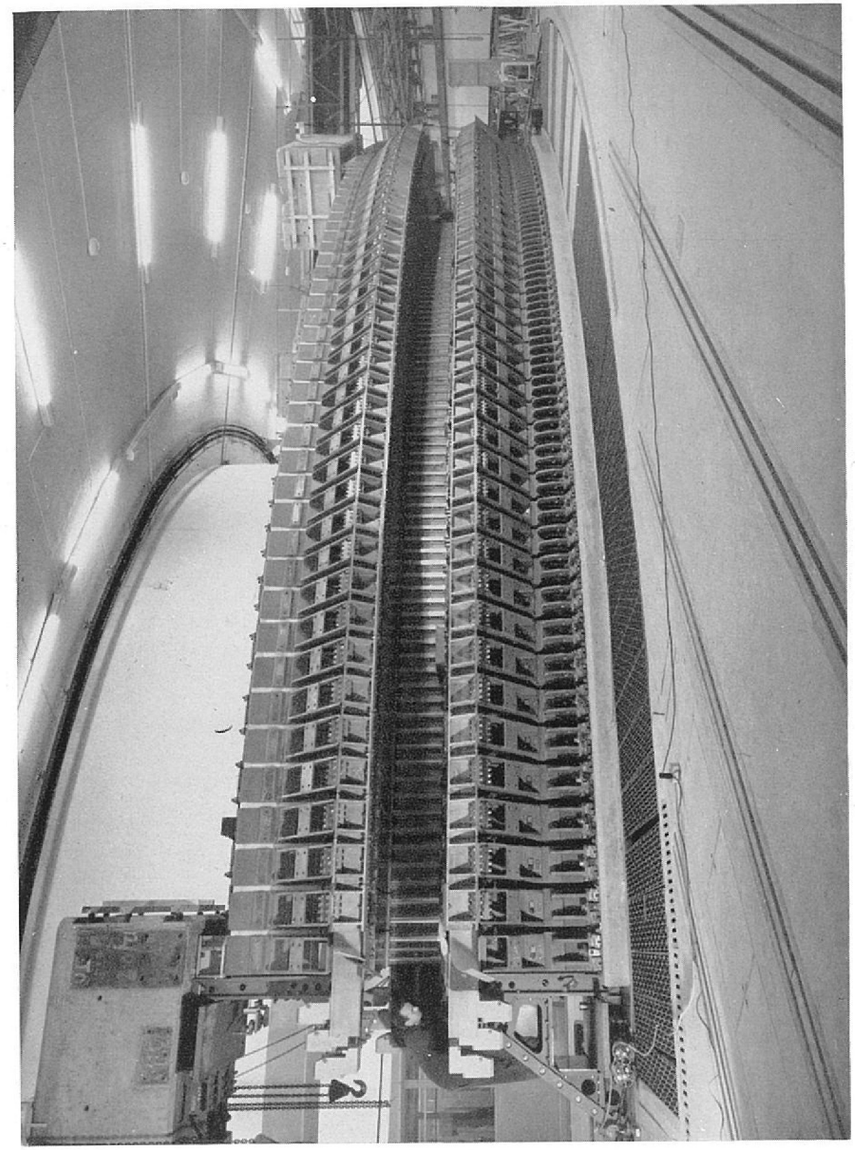
The following supplement to the report is a summary of the major events which have occurred between March 31st and September 30th, 1961.

NIMROD

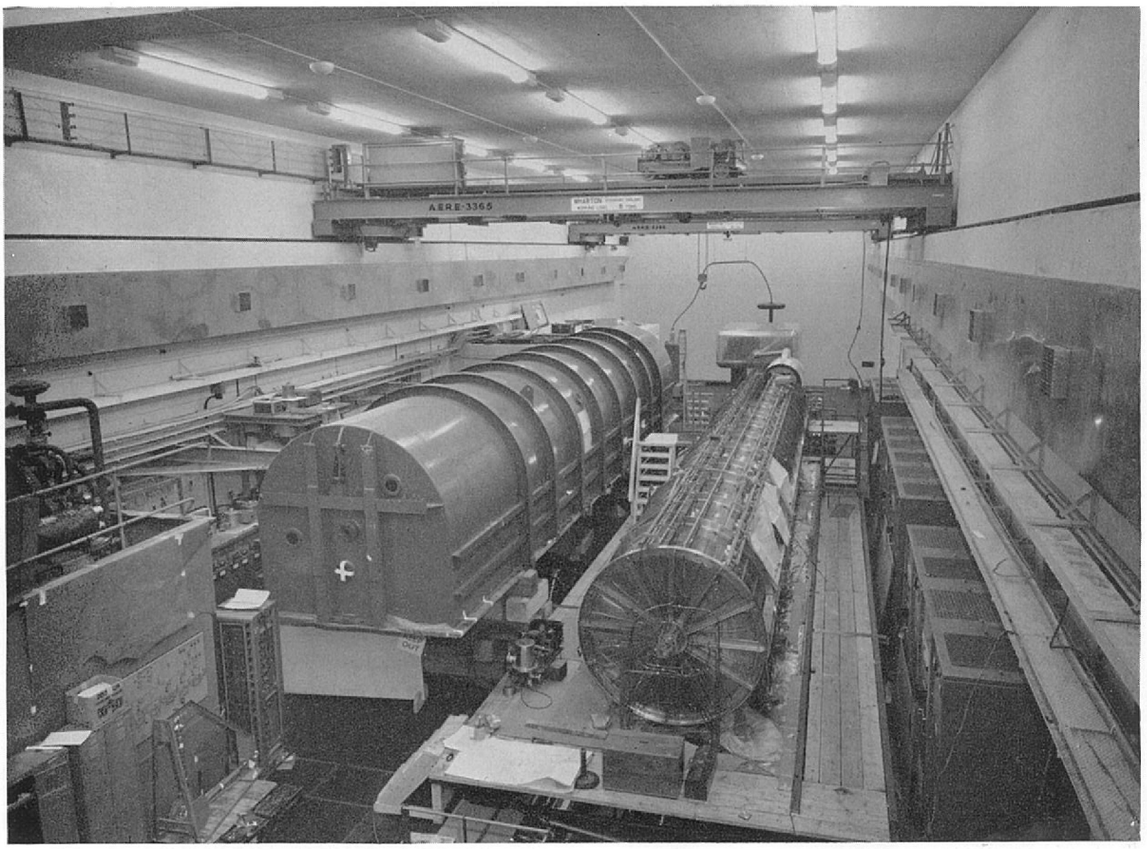
On 1st August, 1961, the first proton beam accelerated to the design energy of 15 million electron volts (15 MeV) was obtained from the Nimrod Injector (as forecast in para. 22).

OXFORD ELECTROSTATIC ACCELERATOR

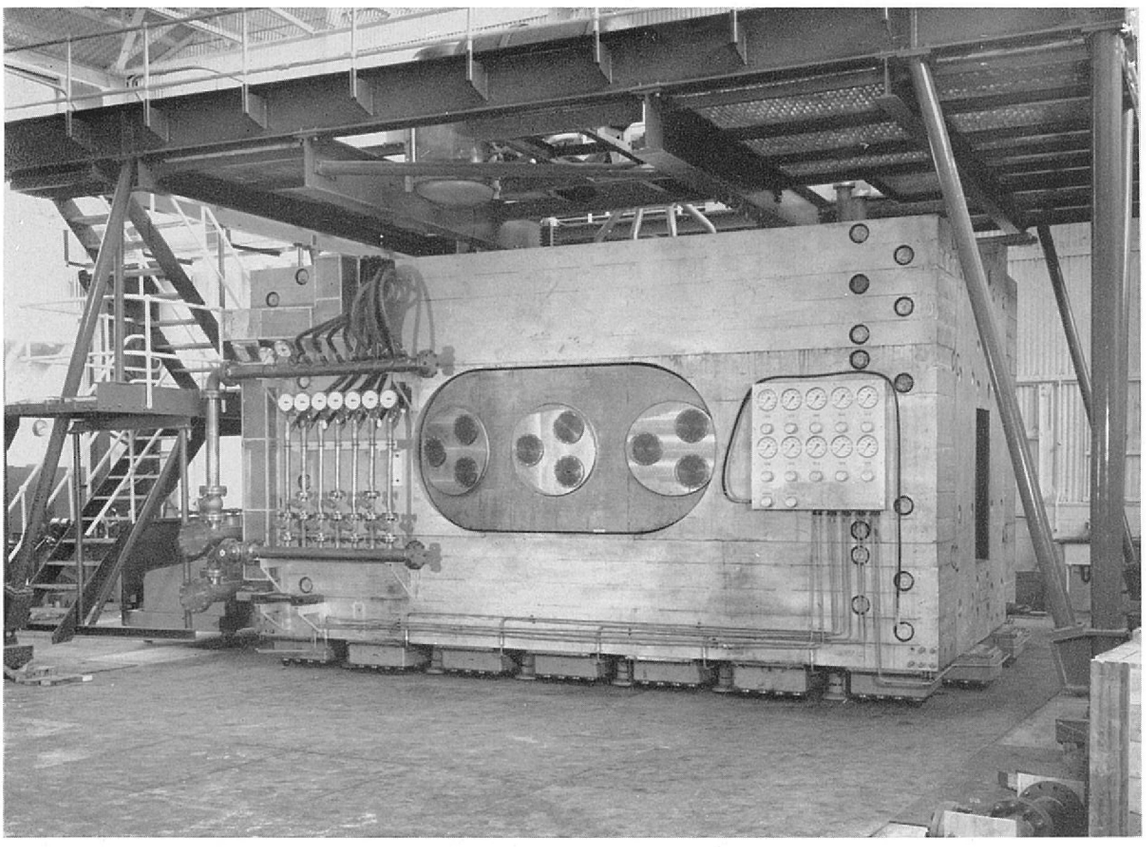
In June it was announced that Treasury approval had been given for a new Nuclear Research Centre for Oxford University. The central feature of this centre will be a 20 MeV electrostatic accelerator, the first stage of which will be an 8–10 MeV Van de Graaff vertical machine to be designed by the National Institute. The Institute will also supervise the construction of the whole machine. This is an example of the way in which the Institute can assist universities with their accelerator projects.



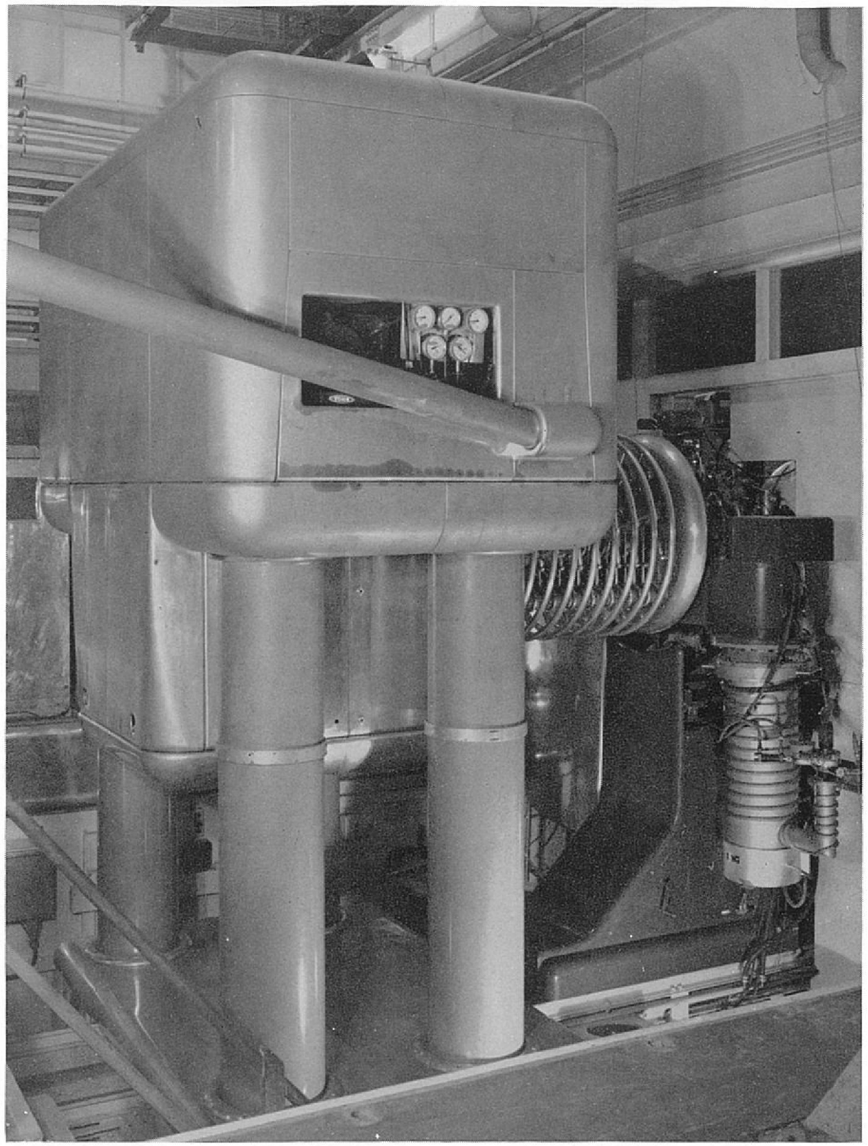
Interior of Nimrod Magnet Room showing one of the octants nearing completion (December 1960).



Nimrod injector with vacuum vessel cover removed showing the liner.



The 60 inch Hydrogen Bubble Chamber constructed by a combined university group.



The polarized proton source installed on the Proton Linear Accelerator.

ATLAS COMPUTER

At the request of the Government, the Institute have agreed to manage a very fast electronic digital computer, which will be installed at the Rutherford Laboratory for use by universities, the U.K.A.E.A., government departments and the National Institute itself. The machine is a Ferranti "Atlas" computer. It was ordered in August, 1961, and should be ready for use early in 1964. This will be an unusual activity for the Institute, because nuclear science will only be one among many subjects in which the computer will be used. The Institute's usual policy of not charging universities for the use of Institute equipment will be followed in the case of the Atlas Computer both for nuclear science and for any other research use. It has been agreed that the U.K.A.E.A. and Government Departments, on the other hand will pay for the time they use on the computer.

The Institute have set up a committee including many leading computer specialists and users, to control the provision and use of the Atlas Computer. The membership is as given below:—

*Sir William Penney (*Chairman*)
*Dr. J. B. Adams—Atomic Energy Authority
Dr. R. A. Buckingham—University of London
*Sir John Cockcroft—University of Cambridge
Dr. J. Howlett—Atomic Energy Authority
Dr. J. C. Kendrew—University of Cambridge
Professor T. Kilburn—University of Manchester
Mr. M. J. Lighthill—Royal Aircraft Establishment, Farnborough
*Sir Harrie Massey—University College London
*Professor R. E. Peierls—University of Birmingham
Dr. T. G. Pickavance—Rutherford High Energy Laboratory
Sir Graham Sutton—Meteorological Office
Dr. F. A. Vick—Atomic Energy Authority
Dr. M. V. Wilkes—University of Cambridge

Secretary : Dr. J. A. V. Willis—Rutherford High Energy Laboratory

(*A member of the Governing Body of the Institute)

PROPOSED HIGH ENERGY ACCELERATOR

The Institute have been giving detailed consideration to the future needs in this country for high energy accelerators, i.e. for energies of more than about 0·5 GeV. They have concluded that there is a pressing need for an electron accelerator of a few GeV, and accordingly a design study has been carried out for a 4 GeV electron synchrotron. A proposal to build such a machine in a new Institute Laboratory is at present under consideration.

STAFF

The number of staff in post at the Rutherford Laboratory was 657 on 30th September, 1961.

APPENDIX I — Accounts

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

Revenue Account for the period ended 31st March, 1960
(including expenditure incurred prior to 23rd June 1958—date of incorporation)

	£		£
Salaries and Wages	44,567	Grant from the United Kingdom Atomic Energy Authority to meet Recurrent Expenditure	1,988,479
Employers' Superannuation Contribution	2,836	Miscellaneous Income	90
Employers' National Insurance Contribution	801		
Travel and Subsistence Expenses	5,959		
Materials and Services	534		
Research and Development by Universities and Industry	5,917		
Hostel Expenses	230		
Miscellaneous Expenses	2,268		
Supplies and Services by the United Kingdom Atomic Energy Authority	1,925,475		
	£1,988,569		£1,988,569

Capital Account as at 31st March, 1960

Capital Grant Account	£	*Assets at cost*	£
As at 23rd June, 1958	539,276	Land and Buildings	2,217,069
Add Grant from the United Kingdom Atomic Energy Authority to meet Capital Expenditure	4,122,668	Plant and Machinery, Ancillary Installations and Motor Vehicles	656,376
Transfer of assets at valuation from the United Kingdom Atomic Energy Authority	1,000,190	Loose Apparatus, Tools, Furniture, Fittings and Office Machinery	24,965
			2,898,410
		Assets in course of construction	2,763,724
	£5,662,134		£5,662,134

NOTE.—Capital Expenditure authorised but not provided for in these Accounts amounted to £6,672,948 of which £3,332,446 has been committed contractually.

BRIDGES, *Chairman.*
J. A. V. WILLIS, *Secretary.*

I have examined the above Accounts. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Accounts are correct.

EXCHEQUER AND AUDIT DEPARTMENT,
11th May, 1961.

E. G. COMPTON,
Comptroller and Auditor General.

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

Revenue Account for the year ended 31st March, 1961

	£			£
Salaries and Wages	241,573	Grant from United Kingdom Atomic Energy Authority to meet Recurrent Expenditure		
Employers' Superannuation Contribution	16,809	Research, Administration, etc	1,901,271	
Employers' National Insurance Contribution	4,107	Capital Expenditure	1,537	
Travel and Subsistence Expenses	18,721			1,902,808
Materials and Services	192,005	Receipts from Hostels		2,186
Research and Development by Universities and Industry	39,504	Miscellaneous Income		634
Hostel Expenses	4,638			
Miscellaneous Expenses	10,791			
Supplies and Services by the United Kingdom Atomic Energy Authority	1,377,480			
	£1,905,628			£1,905,628

Capital Account as at 31st March, 1961

Capital Grant Account	£	*Assets at Cost*	£
Balance as at 1st April, 1960	5,662,134	Land and Buildings	2,541,106
Add Grant from the United Kingdom Atomic Energy Authority to meet capital expenditure for the year ended 31st March, 1961	3,203,952	Plant and Machinery, Ancillary Installations and Motor Vehicles	2,329,502
Expenditure from Revenue Account	1,537	Loose Apparatus, Tools, Furniture, Fittings and Office Machinery	92,766
			4,963,374
		Assets in course of construction	3,904,249
	£8,867,623		£8,867,623

NOTES.—1. Capital Expenditure authorised but not provided for in these Accounts amounted to £7,150,977 of which £2,947,762 has been committed contractually.

2. Housing loans to Institute staff have been and will be made by the United Kingdom Atomic Energy Authority and therefore are not included in these Accounts.

BRIDGES, *Chairman.*
J. A. V. WILLIS, *Secretary.*

I have examined the above Accounts. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Accounts are correct.

EXCHEQUER AND AUDIT DEPARTMENT,
10th November, 1961.

E. G. COMPTON,
Comptroller and Auditor General.

APPENDIX II

Membership of the Governing Body of the National Institute for Research in Nuclear Science March 1961

Chairman : The Rt. Hon. Lord Bridges, G.C.B., G.C.V.O., F.R.S.

Representing the Universities :

Sir Robert Aitken, M.D.
Professor J. M. Cassels, F.R.S.
Sir John Cockcroft, O.M., K.C.B., C.B.E., F.R.S.
Sir Harrie Massey, F.R.S.
Professor R. E. Peierls, C.B.E., F.R.S.
Professor D. H. Wilkinson, F.R.S.
Sir John Wolfenden, C.B.E.

Representing the University Grants Committee :

Professor F. W. R. Brambell, F.R.S.
Sir Keith Murray

Representing the Royal Society :

Sir William Hodge, F.R.S.

Representing the Atomic Energy Authority :

Dr. J. B. Adams
Sir Alan Hitchman, K.C.B.
Sir William Penney, K.B.E., F.R.S.

Representing the Department of Scientific and Industrial Research :

Professor P. I. Dee, C.B.E., F.R.S.
Sir Harry Melville, K.C.B., F.R.S.

Secretary : Dr. J. A. V. Willis

APPENDIX III

Membership of Committees of the Governing Body of the National Institute for Research in Nuclear Science March 1961

General Purposes Committee

Chairman : *The Rt. Hon. Lord Bridges, G.C.B., G.C.V.O., F.R.S.	
*Sir Robert Aitken, M.D.	*University of Birmingham*
Mr. A. E. Drake, O.B.E.	*Atomic Energy Authority*
*Professor R. E. Peierls, C.B.E., F.R.S.	*University of Birmingham*
*Professor D. H. Wilkinson, F.R.S.	*University of Oxford*
Secretary : Dr. J. A. V. Willis . .	*Rutherford High Energy Laboratory*

Physics Committee

Chairman : *Sir John Cockcroft, O.M., K.C.B., C.B.E., F.R.S.	*University of Cambridge*
*Dr. J. B. Adams	*Atomic Energy Authority*
Dr. A. Ashmore	*Queen Mary College, London*
Dr. E. Bretscher	*Atomic Energy Authority*
Professor W. E. Burcham, F.R.S. . .	*University of Birmingham*
Professor C. C. Butler	*Imperial College of Science and Technology*
*Professor J. M. Cassels, F.R.S. . .	*University of Liverpool*
*Professor P. I. Dee, C.B.E., F.R.S. . .	*University of Glasgow*
Professor N. Feather, F.R.S. . .	*University of Edinburgh*
Professor B. H. Flowers, F.R.S. . .	*University of Manchester*
Professor J. C. Gunn	*University of Glasgow*
Professor J. Hamilton	*University College London*
*Sir Harrie Massey, F.R.S.	*University College London*
Mr. L. B. Mullett	*Rutherford High Energy Laboratory*
Professor P. B. Moon, F.R.S. . .	*University of Birmingham*
Dr. E. B. Paul	*Atomic Energy Authority*
*Professor R. E. Peierls, C.B.E., F.R.S.	*University of Birmingham*
Dr. T. G. Pickavance	*Rutherford High Energy Laboratory*
Professor C. F. Powell, F.R.S. . .	*University of Bristol*
Professor G. D. Rochester, F.R.S. . .	*University of Durham*
Professor A. Salam, F.R.S.	*Imperial College of Science and Technology*
Dr. G. H. Stafford	*Rutherford High Energy Laboratory*
**Sir George Thomson, F.R.S. . .	*University of Cambridge*
*Professor D. H. Wilkinson, F.R.S.	*University of Oxford*
Secretary : Dr. J. A. V. Willis . .	*Rutherford High Energy Laboratory*

Visiting Committee

Chairman : *Sir Harrie Massey, F.R.S.	*University College London*
Dr. E. Bretscher	*Atomic Energy Authority*
Professor W. E. Burcham, F.R.S. . .	*University of Birmingham*
Professor C. C. Butler	*Imperial College of Science and Technology*
*Professor P. I. Dee, C.B.E., F.R.S. . .	*University of Glasgow*
Professor B. H. Flowers, F.R.S. . .	*University of Manchester*
Professor O. R. Frisch, O.B.E., F.R.S.	*University of Cambridge*
Professor P. B. Moon, F.R.S. . .	*University of Birmingham*
*Professor R. E. Peierls, C.B.E., F.R.S.	*University of Birmingham*
Dr. T. G. Pickavance	*Rutherford High Energy Laboratory*

Professor C. F. Powell, F.R.S. ..	*University of Bristol*
Professor A. Salam, F.R.S. ..	*Imperial College of Science and Technology*
*Professor D. H. Wilkinson, F.R.S.	*University of Oxford*

Joint Secretaries : Dr. G. H. Stafford
Rutherford High Energy Laboratory
Dr. J. A. V. Willis
Rutherford High Energy Laboratory

Personnel Committee

Chairman : *The Rt. Hon. Lord Bridges, G.C.B., G.C.V.O., F.R.S. .. ..

*Professor J. M. Cassels, F.R.S. ..	*University of Liverpool*
Mr. H. G. Lindsell, C.B.	*Atomic Energy Authority*
*Sir Harrie Massey, F.R.S.	*University College London*
Dr. T. G. Pickavance	*Rutherford High Energy Laboratory*
Dr. F. A. Vick, O.B.E.	*Atomic Energy Authority*
*Sir John Wolfenden, C.B.E. ..	*University of Reading*

Secretary : Dr. J. A. V. Willis .. *Rutherford High Energy Laboratory*

Research Reactor Committee

Chairman : *Sir John Cockcroft, O.M., K.C.B., C.B.E., F.R.S. .. .. *University of Cambridge*

Dr. V. S. Crocker	*Atomic Energy Authority*
Dr. S. C. Curran, F.R.S.	*Royal College of Science and Technology, Glasgow*
**Professor J. Diamond	*University of Manchester*
Dr. P. A. Egelstaff	*Atomic Energy Authority*
*Sir Harry Melville, K.C.B., F.R.S.	*Department of Scientific and Industrial Research*
*Sir Keith Murray	*University Grants Committee*
Dr. T. G. Pickavance	*Rutherford High Energy Laboratory*

Secretary : Dr. J. A. V. Willis .. *Rutherford High Energy Laboratory*

*A Member of the Governing Body of the Institute.
**A former Member of the Governing Body of the Institute.

APPENDIX IV

List of the Senior Staff at the Rutherford High Energy Laboratory March 1961

Director :	Dr. T. G. Pickavance
Assistant Director : (Accelerator and Applied Physics)	Mr. L. B. Mullett
Chief Engineer :	Mr. P. Bowles
Secretary :	Dr. J. A. V. Willis
Head of the Electrostatic Generator Group :	Dr. W. D. Allen
Head of the Proton Linear Accelerator Group : ..	Dr. G. H. Stafford
Head of the Theoretical Studies Group :	Mr. W. Walkinshaw
Head of the Bubble Chamber and Radiation Protection Groups :	Mr. M. Snowden
Head of the Engineering Design Group :	Mr. G. E. Simmonds
Head of the Engineering Services Group :	Mr. J. C. Louth
Head of the Nimrod Magnet and Beam Handling Groups :	Mr. J. J. Wilkins

APPENDIX V

List of Publications by Rutherford Laboratory Staff April 1960 to March 1961

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Billinge, R.	An achromatic inflector system for Nimrod. A.E.R.E. Report No. 3475, Spetember, 1960. (On sale through H.M.S.O., price 3s. 6d.)
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JONES, D. — Transistorized vacuum trip unit. J. Sci. Instruments, vol. 38, no. 2, pp. 51–53, February 1961.

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KNIGHT, K. M. — Trigger pulse scaler. Section CN/2. Rutherford Laboratory P.L.A. Handbook. January, 1961.

LAWSON, J. D. LORD, D. H. and RUSSELL, F. M. — Pendulum analogues to illustrate the periodic motion in spiral ridge accelerators. J. Nucl. Energy, Part C, vol. 1, no. 3, pp. 124–129, 1960.

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