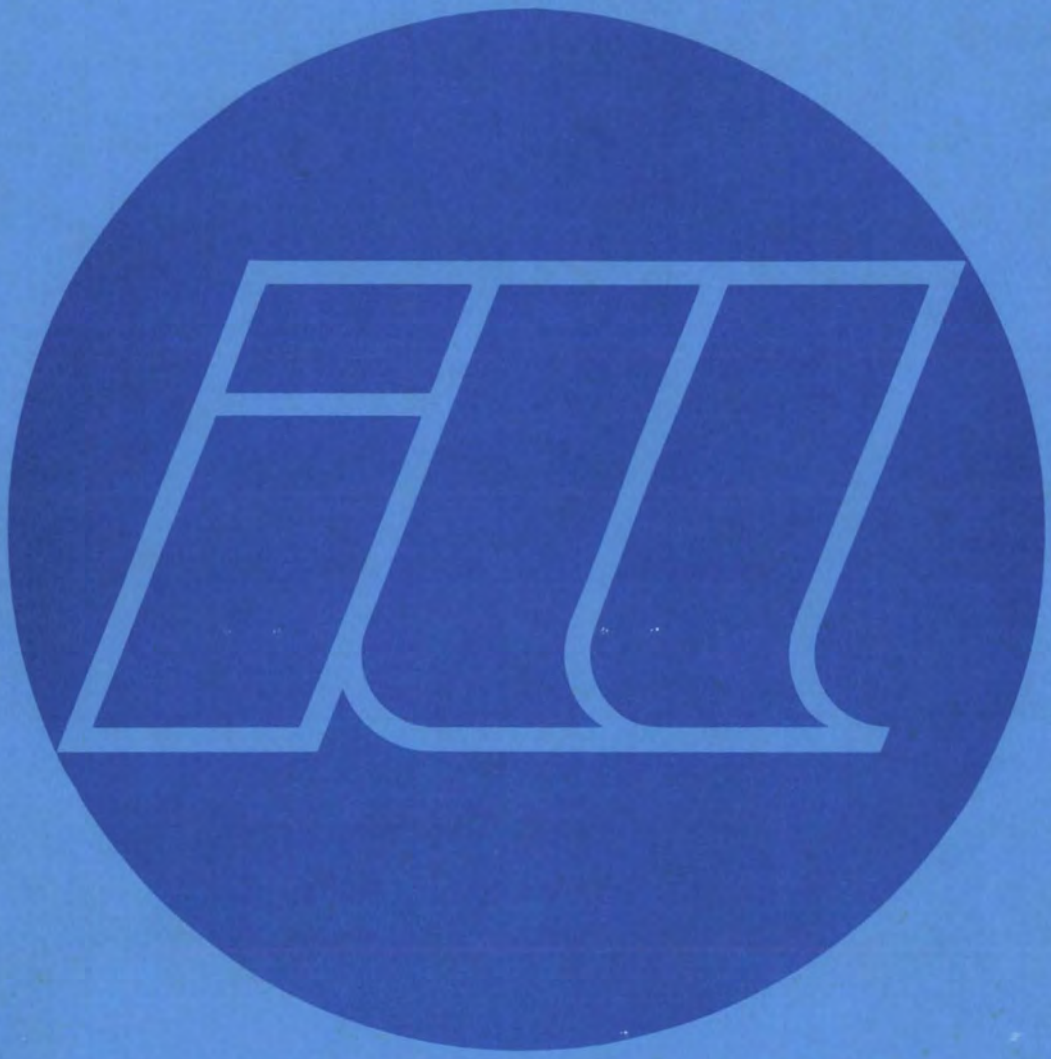

annual report 1974

institut max von laue · paul langevin
b.p.156 centre de tri·38042 grenoble cedex·france tél.(76)97·41·11

Application for use of I.L.L. facilities.

All research proposals should be sent to the Office of the Scientific Secretary :

B. MAIER
Institut Laue-Langevin
B.P. 156 Centre de tri
38042 Grenoble Cedex
France

Tél. (76) 97.41.11 poste 82.44

Appropriate forms are obtainable on request from this office.
The closing dates for acceptance of applications are as follows :
August 31 and February 15.

All proposals are submitted to the Scientific Council for approval.

It should be noted that the ILL in general provides free of charge the neutron beams and standard measuring equipment, such as existing spectrometers, counters, standard cryostats and shielding equipment. Other special equipment, in particular samples, must be provided by the user.

The ILL pays for travel and subsistence of one experimentalist per experiment for personnel from laboratories of the 3 member countries.

annual report 1974

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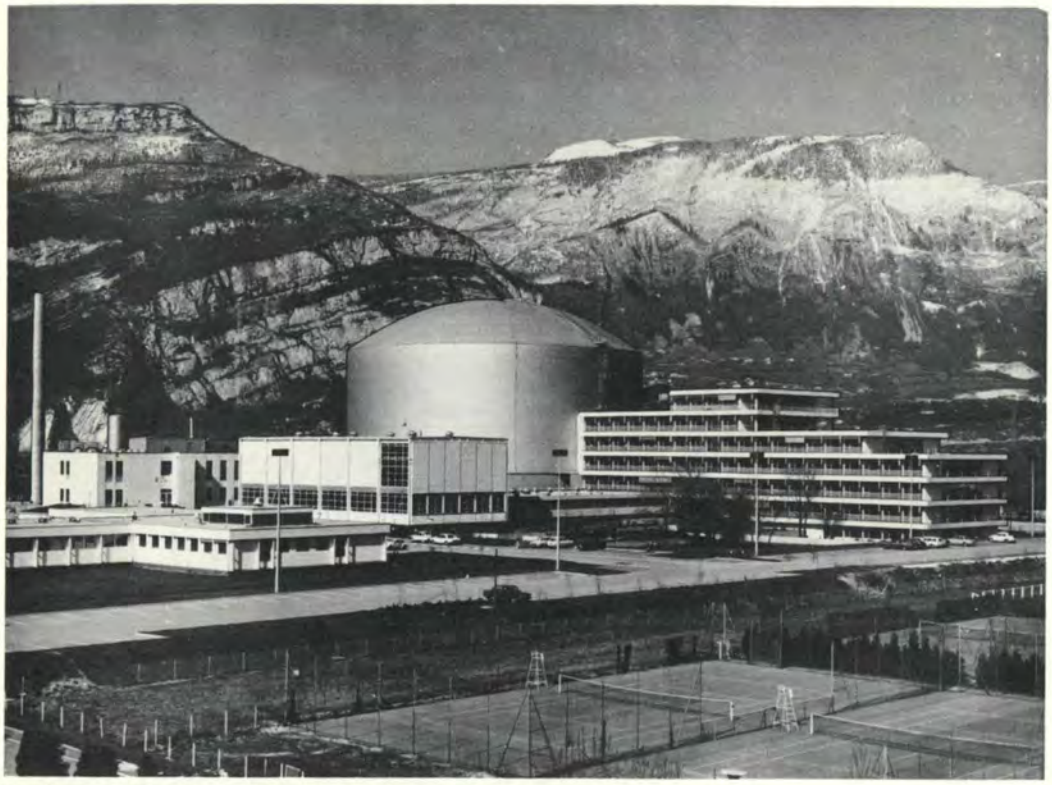
table of contents



The Institut Laue-Langevin with the Vercors Mountains in the background.

external organisation of the institut laue·langevin 1974

associates of the institut

great britain

SCIENCE RESEARCH COUNCIL (SRC)

france

COMMISSARIAT A L'ENERGIE ATOMIQUE (CEA)

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS)

west germany

GESELLSCHAFT FÜR KERNFORSCHUNG KARLSRUHE (GfK)

steering committee

(at its last meeting)

great britain	france	west germany
L. Hobbis	J. Cantacuzène - (CNRS)	L. Genzel
W. Mitchell	P. Creyssel - (CNRS)	R. Greifeld
J. Paton	J. Horowitz - (CEA) President	W. Hofbauer
M. Robins - Vice President	M. Pascal - (CEA)	W. Menden

scientific council

(at its last meeting)

great britain		france		west germany	
G. Allen	- Univ. Manchester	A. Abragam	- CEN Saclay	H. Bilz	- MPI Stuttgart
W. Cochran	- Univ. Edinburgh	E. Bertaut	- CNRS Grenoble	W. Dransfeld	- MPI Grenoble
R. Elliot	- Univ. Oxford	M. Farragi	- CEN Saclay	W. Gläser	- GfK Karlsruhe
J. Enderby	- Univ. Leicester	J. Friedel	- Univ. Paris Sud	W. Hoppe	- MPI Martinsried
D. Philips	- Univ. Oxford	A. Guinier	- Univ. Paris Sud	P. Kienle	- TU München
T. Waddington	- Univ. Durham	V. Luzzati	- CNRS, Gif-sur-Yvette	R. Mössbauer	- ILL - Chairman
				T. Springer	- KFA Jülich

audit commission

great britain	france	west germany
R. Mead	J. Couzien	W. Becker
R. Tunnicliff	J. Lacroix	W. Riess

The institut max von laue·paul langevin

The Institut Max von Laue - Paul Langevin (ILL) at Grenoble was formally founded in January 1967, with the signature of an intergovernmental convention between France and the Federal Republic of Germany. The aim was to provide the scientific community of the affiliated countries with a unique neutron beam facility applicable in fields such as the physics of condensed matter, chemistry, biology, nuclear physics and materials sciences. The construction of the institute and its high flux reactor was undertaken as a joint French-German project, with a total capital investment of 335 million FF. The reactor went critical in August 1971 and reached its full power of 57 MW for first time in December 1971. The year 1972 saw the start-up of the cold and hot sources, the first instruments and the beginning of the experimental program. On January 1, 1973, the United Kingdom joined the Institute as a third equal partner, contributing its share to the total capital investment. The corresponding intergovernmental convention was formally signed in July 1974 by the pertinent ministers from the three affiliated countries.

The ILL is a non-trading company under French civil law. The three countries are represented by the following Associates :

- Gesellschaft für Kernforschung mbH Karlsruhe, Germany (33%)
- Centre National de la Recherche Scientifique, France (17%)
- Commissariat à l'Energie Atomique, France (17%)
- Science Research Council, United Kingdom (33%)

These Associates are represented on a Steering Committee, which establishes the general rules of the management of the ILL. The Institute is headed by a Director and two Assistant-Directors, all with a five year tenure, the former to be nominated alternately by the German and the British Associate, the other two by the complementary Associates. A Scientific Council nominated by the Associates, advises the Directors of the scientific programme and on practical aspects·relating to its operation.

The scientific user's community of the ILL is represented in 7 Subcommittees of the Scientific Council, which meet twice a year to select those research proposals which are to be carried out at the neutron beam facilities of the ILL. A further Subcommittee of the Scientific Council deals with questions of instrumentation, serving as a discussion platform between the ILL and its external users.

The purpose of the ILL thus differs fundamentally from most other Research Institutes. It is a central facility created so that chemistry, physics, biology and metallurgy specialists from laboratories in the partner countries can use the unique power of neutron techniques to broaden the attack on their problems. Designing and operating instruments and helping the visiting users to carry out their experiments is thus the principal task of the Institute's own scientists. The experimental use of the instruments by ILL staff is subject to the same approval system as their use by external teams.

internal organisation of the institut laue-langevin at 1.12.74

DIRECTORATE

R. Mössbauer - Director
B. Dreyfus - Co-Director
M. Lomer - Co-Director

SCIENCE BOARD

J. Brown
B. Dorner
B. Dreyfus
B. Jacrot
M. Lomer
R. Mössbauer

MANAGEMENT BOARD

B. Dreyfus
M. Jacquemain
M. Lomer
R. Mössbauer
A. Plattenteich

COLLEGES
(College Secretaries)

COLLEGE 2 : THEORY
P. Nozières

COLLEGE 3 : NUCLEAR PHYSICS
M. Asghar

COLLEGE 4 : EXCITATIONS
S. Lovesey

COLLEGE 5 : STRUCTURES
B. Klar

COLLEGE 6 : LIQUIDS, GASES AND AMORPHOUS MATERIALS
F. Volino

COLLEGE 7 : IMPERFECTIONS
W. Just

COLLEGE 8 : BIOCHEMISTRY
J. Higgins

COLLEGE 9 : CHEMISTRY
J. Higgins

INSTRUMENT GROUPS
(Group coordinators)

3 AXIS SPECTROMETERS
R. Currat

SPECIAL 3 AXIS SPECTROMETERS
R. Scherm

TIME OF FLIGHT SPECTROMETERS
F. Douchin

CRYSTALLOGRAPHIC INSTRUMENTS
M. Thomas

DIFFUSE SCATTERING INSTRUMENTS
M. Roth

POWDER SPECTROMETERS
P. Convert

POLARISED NEUTRON SPECTROMETERS.
F. Tasset

MONOCHROMATOR GROUP
A. Freund

NUCLEAR PHYSICS INSTRUMENTS
N.N.

SERVICES

TECHNICAL SERVICES
M. Jacquemain

REACTOR OPERATION AND INSTRUMENT SUPPORT SERVICES
Y. Droulers

COMPUTING SERVICES
D. Rimmer

ADMINISTRATION
A. Plattenteich

SCIENTIFIC SECRETARY

B. Maier

PROJECTS OFFICE

J. Faudou

introduction

GENERAL REMARKS ABOUT THE INSTITUTE ACTIVITIES IN 1974

In 1974, the main efforts of the ILL have been directed towards the execution of a large number of externally approved experiments. The Institute due to its unique facilities has quickly become highly attractive, with the measuring time demanded by various research centres and university laboratories in the three member countries rising to such a level, that all instruments are now heavily overloaded, necessitating the application of very strict criteria for the acceptance of experimental proposals. This situation has prevailed in spite of the fact that multinational collaboration between research groups with similar orientation has become common. The three-country collaboration has generally proved very fruitful. It has enabled the ILL to call on a large number of laboratories in its efforts to improve its scientific and technical efficiency. At the same time the Institute has acted as a catalyst and a discussion centre for a large number of scientists in the three countries and elsewhere, leading to many contacts, producing numerous exchanges of ideas and of scientific and technical know-how, thus speeding up new developments and avoiding costly duplications of work. The present report demonstrates that the unique facilities of the ILL have enabled many new and previously impossible studies to be performed by a large and genuinely international scientific community.

In 1974, 22 different neutron spectrometers of varying design have been available for regular use. In addition, a number of special neutron beams was available for on-line experiments. Nearly 800 visitors from 14 different countries have come to the Institute. A total of 344 experiments have been performed, involving scientists from 102 different laboratories, with the individual experiment ranging in time from a few hours up to the entire year. The following table, which applies to the period January 1, 1974 - January 1, 1975 illustrates the diversity and scope of the experimental programme :

Field	Instrument days	Detail	
Biology	98	20 experiments on 4 instruments	
Chemistry	135	24	7
Crystal structures	768	82	14
Liquids and amorphous substances	321	33	10
Diffuse scattering	115	19	5
Phonons	449	37	7
Phase transitions	99	12	6
Magnetic structures	356	46	10
Magnons	234	19	5
Crystalfields	42	4	1
Nuclear physics	560	45	8
Miscellaneous	530	3	3

The number of experiments accepted by the Scientific Council and still to be carried out at present exceeds 300.

Besides the execution of the experimental programme the ILL has been heavily engaged, in partial collaboration with other laboratories in the three countries, in extending its experimental facilities and in pursuing the development of new measuring techniques. A total of 9 new instruments in fact went into operation in 1974. In particular, for the fission spectrometer «Lohengrin», the technical problems associated with the source carrier reported last year, were solved. Work on an additional 6 instruments has continued and on 4 work was freshly begun. Particular efforts went into the production of more efficient monochromators, of promising new types of spin-flippers, neutron polarisers and analysers, and of ancillary cryogenic equipment. A number of working groups was engaged in the further study of new methods in neutron spectroscopy, such as the development of new high resolution techniques, of high intensity systems, of an ultracold neutron source and of multi-detector-systems.

Budgetary limitations have created certain strains on the operation of the Institute : the lack of sufficient technical staff, both for the operation and of maintenance of the neutron spectrometers and in the supporting services such as cryogenics and elec-

tronics, has appeared as the most restrictive bottleneck in the implementation of the experimental programme. Another area of concern has been the computer system «Nicole» which at present controls 5 major instruments. This system shows serious signs of wear in hardware as well as program language short-comings ; it requires an unusually expensive backup by a highly skilled technical staff. An early replacement by small individual instrument - dedicated computers still appears impossible for budgetary reasons. With this exception the different computer systems, including the general calculating facility, have shown a very satisfactory performance.

The local international class in a Grenoble elementary school has successfully completed its first year. Negotiations with the Franch Authorities have now also led to the creation of a first grade of an international class in a high school, which will be supplemented by another grade in each successive year.

The total authorized budget of the ILL in 1974 amounted to 65.3 million FF. The number of staff paid from ILL funds was 373 on December 31, 1974. The current economic climate makes budget planning particularly difficult, and perturbations of cost and availability of highly enriched uranium are of special importance to the Institute.

The reactor has now been formally accepted by the relevant French licencing authority (S.C.S.I.N. - Service Central de Sécurité des Installations Nucléaires) for routine operation, and falls under this Committee for routine inspection. As last year, there were no incidents endangering the reactor, and no exposure of any personnel to more than the permitted annual radiation dose. An incident involving radioactive contamination of the reactor swiming pool caused some operating difficulty for two weeks and is described in the chapter on the Reactor Service.

The following report gives a survey of the state of the experimental facilities at the ILL and of the scientific work carried out in 1974, as well as of the main technical and administrative features of the operation of the Institute. A second volume of this report gives more detailed descriptions of individual experiments. A special brochure attached to this report provides information on the neutron spectrometers and on other experimental facilities which are presently available for external users of the ILL.

Grenoble, January 3, 1975

R.L. MÖSSBAUER.

visit of three ministers to I LL

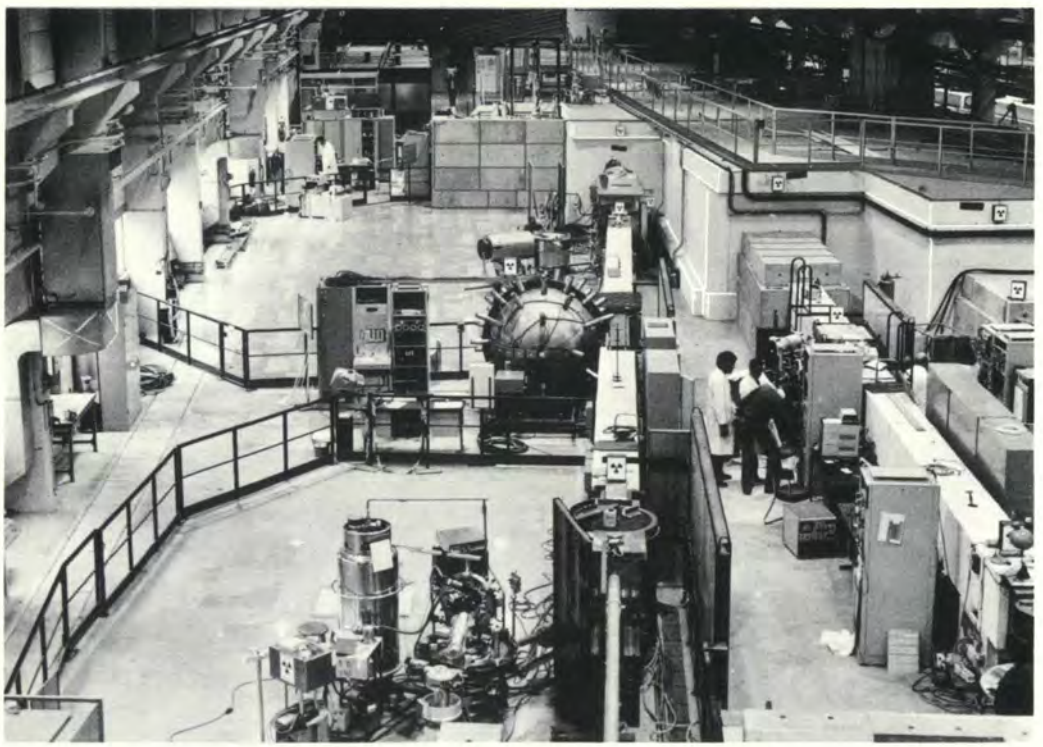
On Friday 19 July 1974 the Ministers responsible for research in Britain, France and Germany came to Grenoble to sign the legal documents admitting the Science Research Council to membership of ILL.

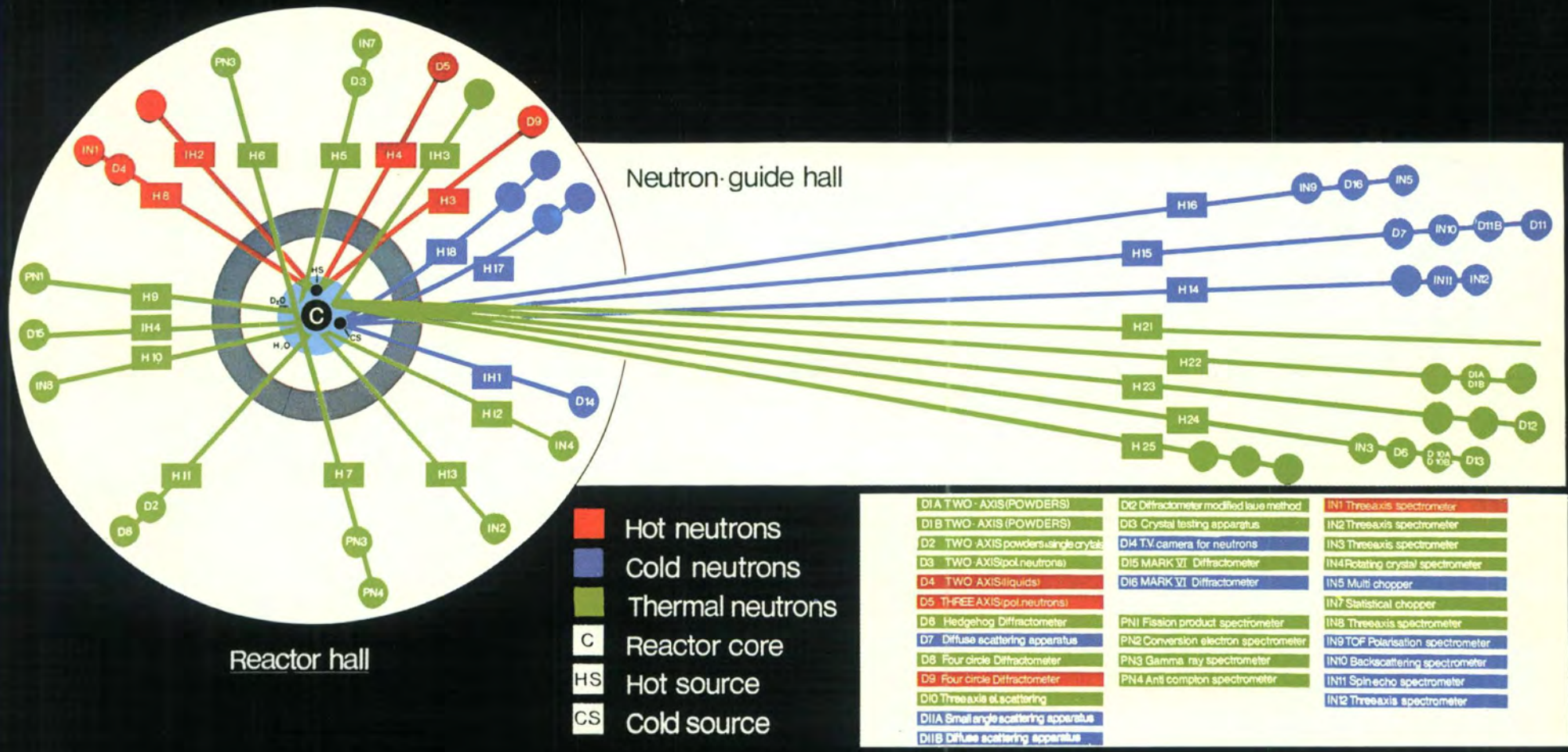
They were M. Michel d'Ornano, Ministre de l'Industrie et de la Recherche; Herr Hans Matthöfer, Bundesminister für Forschung und Technologie; and Mr Reg Prentice, Minister for Education and Science. Accompanying them were Herr von Braun, the German Ambassador in Paris, Mr. Arculus representing the British Ambassador in Paris as well as high ranking Governmental officials and Scientists from the three countries. The visitors were received in Grenoble by M. René Janin, Préfet de l'Isère.
The day began at the Institut where the Ministers and visitors heard a short speech from the Director of the Institut. This was followed by a visit of the reactor and the experimental facilities.
The signing ceremony was held at the Préfecture de l'Isère in Grenoble. At the same time as the Ministers were signing the intergovernmental convention, the representatives of the 4 associates (CEA, CNRS, GfK and SRC) were signing an agreement between themselves admitting the SRC.
After the signing ceremony the 3 Ministers made short speeches with a strong emphasis on the importance of international collaboration in scientific research. Following this, lunch was taken at the Préfecture and in the afternoon there was an informal buffet at ILL attended by the Ministers and visitors and all the staff of ILL.

M. M. d'Ornano (France) | M. R. Prentice (Britain) | Herr H. Matthöfer (Germany)

instrumentation

A general view of instruments in the neutron guide hall. This picture shows clearly the guide tube H 24 and the two triple axis spectrometers D10 (nearest) and IN3, separated by the «Hedgehog» D6.





Beam tube arrangement and instruments at the H.F.R. of the I.L.L.

D Diffractometer
IN Spectrometer for Inelastic Neutron Scattering
PN Nuclear Physics Instruments
H Horizontal Beam-tube or Guide
IH Inclined Beam-tube

instrumentation

INTRODUCTION

During 1974, 20 instruments were operational and at the disposal of in-house and external users for carrying out approved experiments. The organization for instrument support which was created in 1973 and which consisted essentially of placing each instrument into a group according to its scientific classification and under the direction of a «group coordinator», has been found to work well, and it was decided in 1974 to extend this by the creation of a «Project Office». The role of this office will be to coordinate the construction of new instruments and, in cooperation with the group coordinators, progress the modification of existing facilities.

Also during 1974, a supervisor was appointed to control the activity of technicians providing experimental support for the instruments and his main task will be to ensure that the various experiments in the reactor and neutron guide hall are carried out smoothly and efficiently. In an establishment such as the ILL where approximately 320 different experiments are carried out each year on about 30 instrument and other facilities, it is necessary to introduce routine planning in order to ensure that technical support and ancillary equipment are always available to experimentalists. These innovations have therefore been introduced, but with the intention of maintaining a balance between the individual initiative of the scientists, especially the instrument responsibles, and the discipline which such an extensive scientific programme requires.

Table 1 summarizes statistically the operational programme of the instruments, the number of which was increased by 5 during 1974.
Table II outlines the present situation of those instruments still under construction and it should be noted that the completion of some instruments (IN 12, and D 15) mentioned in the 1973 report have been unavoidably delayed, and that IN 6 has been removed from the list completely as it is not proposed to include this instrument because of technical (interference with D 5 and D 9) and budgetary reasons.
Table III lists all projects still requiring precise definition and it should be mentioned that the progress of the work on these instruments will depend on the budget situation.
Table IV shows a compilation of projects not associated with a particular instrument.
Table V shows nuclear physics instruments and statistics.
Table VI lists instruments being used for specific scientific programmes.
More detailed information is given in the brochure «Neutron Research facilities at the HFR» which is attached to this report.

I. - INSTRUMENT OPERATION STATISTICS (JANUARY 1st to DECEMBER 31, 1974)

(SCIENTIFIC EVALUATION AND TEST EXPERIMENTS HAVE NOT BEEN INCLUDED IN THE TOTAL OPERATING TIME)

During the period under review, the Reactor operated at full power
for 252.7 days out of a scheduled operating period of 281 days.

Instrument	Total operating Time for approved expt. (days)	COLLEGE 4	COLLEGE 5	COLLEGE 6	COLLEGE 7	COLLEGES 8/9	COMMENTS
IN1	235.5	158			37	40.5	BERYLLIUM FILTER FACILITY TO BE INSTALLED JANUARY 1975
IN2	200.5	200.5					FULLY OPERATIONAL
IN3	147	96		11	40		This instrument was scheduled as a conventional Triple Axis Spectrometer from 2.4.74 - Test experiments on curved monochromator crystals continuing.
IN4	126.5	43	5	22	36	20.5	The figures have been distorted due to a malfunction of NICOLE 1 resulting in spectra being partially or totally destroyed between April and June. Actual instrument availability was 91%.
IN5	139.5	39		69		31.5	FULLY OPERATIONAL after conclusion of scientific evaluation and instrument testing period.
IN7	65	23			42		This instrument has been subject to modifications and was taken out of commission for the installation of D3. It has been available for scheduled and test experiments from September 1974.
IN10	150.5	60		42.5	13	35	This instrument was commissioned in February 74 and scheduled experimental time has been available only between scientific evaluation experiments. However by July 1974 scheduled experiments represented 63,4% of the available beam time.
D 1 A	197		197				FULLY OPERATIONAL - Continuing programme of improvments to up-grade the performance of this instrument.
D 1 B	100.5		79.5	21			FULLY OPERATIONAL - New multidetector installed during 2nd Semester 1974.

							evaluation tests. Approved test experiments have been scheduled for March 1975.
D 4	192.5			192.5			FULLY OPERATIONAL - Not included are 10 days for instrument modification and testing.
D 5	177		98.5	50.5	28		FULLY OPERATIONAL - Not included are 15 days for instrument testing and monochromator/analyser evaluation experiments.
D 6	125			125			Continuation of preliminary structure experiments. Scheduled for outside users with suitable approved experiments.
D 7	75.5				75.5		This instrument was inoperative for 2 months during 1974 for the installation of new shielding and mechanical improvements. The various operating sequences of this instrument have necessitated considerable test periods and the change to polarized neutrons in Dec. 74 will cause an interruption of the programme for approximately 2.5 months.
D 8	141		110			31	Instrument out of commission for installation of IN 8. Instrument fully operational August 1974.
D 10 A	132		132				FULLY OPERATIONAL
D 11 A	138.5			6.5	49.5	82.5	This instrument is fully operational and subject to many sample changes (approximately 76). During June 74 the efficiency was impaired by data collection faults (NICOLE 1)
D 16	180	SCIENTIFIC EVALUATION OF LONG WAVELENGTH DIFFRACTION					This instrument is being used at present for exploratory experimental purposes and for suitable approved projects.
D 13							This general purpose instrument was in continuous use during the period under review with many short term experiments (crystal orientation, monochromator mosaic/ transmission determination, extinction checks, etc...).
SI 6	In BEAM N.M.R. SPECTROMETER	CONTINUOUS OPERATION THROUGHOUT 1974 -					β - ray asymmetry of β -emmiters after capture of polarized neutrons - experimental proposals for research projects using this instrument can now be accepted.

II. - PROJECTS IN PROGRESS (1974)

INSTRUMENT	COMMENTS
IN 8	Conventional Triple Axis Spectrometer - Installation complete, entering test period : March 75.
IN 9	Polarized Proton Target - Construction and mechanical design work continuing. Improvment of the degree of polarization is still necessary.
IN 11	Spin Echo spectrometer - Manufacture proceeding within budgetary limits. Provisional completion date December 1975 dependant on the progress of development work on polarizing mirrors.
IN 12	Conventional triple Axis spectrometer on cold guide. Provisional installation date December 1975 and operational during 1976 depending on budget position.
D 9	Installation completed test experiments in progress for alignment and scientific evaluation.
D 15	Installation of monochromator housing on inclined hole in progress.
D 11 B	Completion of manufacture by Rutheford Laboratory and integration with D 11 A during the 2nd Semester 1975.
D 12	Diffractometer using photographic Laue method. Quantitative scientific evaluation experiments continuing.

III. - PROJECTS UNDER DEFINITION (1974)

INSTRUMENT	COMMENTS
High Intensity Inelastic Spectrometer for chemical applications	Study group actively engaged in final definition of this instrument
D 17 (New Small angle scattering instrument)	Instrument definition completed. Installation on H. 17 with a new D 11 A type multidetector. Reactor shell penetration during 1st semester 1975 if it is decided to have the instrument in the guide hall.
Ultra Cold Neutron Project	Time-table, budget and financial responsability (SRC/ILL) for installation on IH 3 remain to be fixed. Prototype design of in-pile and external parts of the facility are available. Detailed design work will commence on completion of guide transmission tests, the scheme envisages having an ambient U.C.N. guide in the first instance.
High resolution Powder instrument	No new instrument envisaged at present. Work is continuing to up-grade the performance of D 1 A which will form the basis of any future re-assessment of this project.

IV. - SPECIAL PROJECTS (1974)

INSTRUMENT	COMMENTS
TV camera/neutron phosphor screen	Development of screen and electronics still incomplete.
Polarizing mirrors	Development of mirror polarizing systems in progress at C.E.N. Grenoble and S.R.C. Rutheford Laboratory. Evaluation of the different methods will be concluded during 1975 in order that normal progress on IN 9 and IN 11 can continue.

V. - NUCLEAR PHYSICS OPERATION STATISTICS (1974)

Instrument	Purpose	Instrument days	COMMENTS
PN 1 «Lohengrin»	fission products	appr. 180	PN1 has started its routine operation this year in the beginning of May 74.
PN 2 «BILL»	conversion electrons	appr. 90	PN2 has started its routine operation by mid. September 74.
PN 3 «Gams»	Gamma rays	appr. 130 (I) appr. 110 (II) (III)	Gams I was fully operational by the beginning of January 74. Gams II/III commenced its routine operation in April 74.
PN 4 «Anti-compton» «Pair»	Gamma rays	appr. 50	PN4 was only partly available for routine operation due to the installation of the pair-spectrometer and the accidental destruction of the Ge (Li) detectors.

VI. - SPECIAL BEAM EXPERIMENTS

Instrument	Experiment	Applicants	Beam	COMMENTS
SI 1	Weak interaction between nucleons by measurement of γ -rays assymetry after capture of polarized neutrons in H_2	Jeenike (hardward) Liaud (ISN)	H 142	Preparation of this experiment was continued during 1974. Start of the experiment planned for early 1975.
SI 4	Electric and magnetic dipole moment of the neutron	Dress (Oak Ridge) Perrin (CEN-Grenoble)	H 18	Measurements on the EDM were finished by the end of 1974. The set-up will be transformed for the MDM measurements in 1975.
SI 10	(n, α) reactions	Chery (Lyon)	H 22 waste beam	Experiments have given good results and will be continued in 1975.
SI 12	Bragg diffraction Interferometry with thermal neutrons	Bonse (Dortmund) Rauch (Wien)	H 25	First measurements have given promising results in 1974. The stability of the set-up will be increased in order to improve the results in 1975.
SI 13	Surface density of He^3 on the free surface of He^3-He^4 solutions	Scherm (ILL)	H 17	Test of He-Dilution refrigerator accomplished. Start of experiment planned for Summer 1975.
SI 14	Test of time reversal invariance in weak and electromagnetic interaction processes	Hamilton (Brighton)	H 142	Experiment will be started by the second half of 1975.
SI 15	Search for parity violation in the $n + p \rightarrow d + \gamma$ reaction	Hamilton (Brighton)	H 142	Definition of the experiment still under study.
SI 16	Multiparameter study of the long-range α -particle accompanied fission of ^{236}U induced by thermal neutrons	Asghar (ILL) Perrin (CEN-G) Signarbieux (Saclay)	H 141	Beam available, installation planned for March 1975 Start of experiment planned for Spring 1975.
SI 19	Vortex velocity measurement in type II superconductor	Thorel (ILL)	H 18	The installation and preparation for this experiment will commence in January 1975.

instrument group1
«conventional three·axis spectrometers»

This group includes the following triple axis spectrometers :

IN1 : on the hot source (beam-tube H8)
IN2 : on thermal beam-tube H13
IN8 : on thermal beam-tube H10
IN12 : on cold guide H14

INTRODUCTION :

In 1974, working conditions around the instruments have become generally difficult due to a tight budgetary situation and a shortage of technical staff. A number of modifications or improvements, originally planned for 1974, have been postponed. On the other hand, user's demand for three-axis time remains as high as usual. The result is a continuing pressure to keep the instruments «running as they are», although the need for a long term maintenance policy is becoming more and more serious.

IN1 – HOT SOURCE 3-AXIS (D.Tocchetti)

This instrument has been under continuous operation during 1974. An interruption is scheduled for early January 1975 to permit a complete overhaul of the monochromator drum together with the installation (on the instrument's second arm) of a cooled Be-filter analyser. Experiments performed include magnetic studies (NiV-NiFe alloys, pure and Co-doped NiO, $KCoF_3$, NiS, FeRH, Mn_2CrSb, Cu_2MnA1, Pd_3Fe), as well as optical phonon measurements (MgF_2, $LiNbO_3$, Se, $A1_2O_3$, NiO) and a measurement of S (Q,ω) on liquid N_2 at large Q. The addition of a Be-filter analyser from Harwell, which is currently under test at ILL, will further increase the instrument's versatility.

IN2 – THERMAL BEAM 3-AXIS WITH A DOUBLE MONOCHROMATOR.
(B. Dorner)

This instrument is now entering its third year of operation. It has performed well so far, but a major mechanical and electronic overhaul would be highly desirable. The new collimators, optical bench and cooled Be-filter are now installed and operational. On the other hand, a modification for precise positioning of the monochromator drum, the addition of a second analyser arm, and a new sample goniometer, have been postponed until 1975. Experiments have been performed on magnetic systems (low energy excitations), magnetic defect systems, phonon and libron systems

(MgF_2, InP, Urea, $TiSe_2$), phase transitions and critical phenomena (TMMC, SiO_2, $NaNbO_3$, KCP), systems under pressure or stress ($SrTiO_3$, $FeCl_2$, RbI), plus a number of short feasibility studies.

IN8 – THERMAL BEAM 3-AXIS (R. Currat)

The completion of IN8 has been substantially delayed in order to allow the ILL Technical Staff to carry out priority maintenance tasks on existing instruments. As a result, the electronic tests will continue into January 1975 ; the mechanical assembly was completed at the end of 1974. Much work remains for 1975 (software tests, alignment, neutron tests and construction of various auxiliary equipment), the final commissioning of the instrument should accur in early spring.

IN12 – 3-AXIS ON A COLD GUIDE (W. Stirling)

This instrument still awaits budgetary clearance before work on the mechanical construction can proceed. A description of the present state of the instrument may be found in the «H14 Construction Group» report.

Coordinator, R. Currat.

Triple axis spectrometer - IN 2

instrument group 2
«special three-axis spectrometers»

The group includes the following instruments :

D10B : Four-circle diffractometer at the thermal neutron guide H24
IN3 : Three-axis spectrometer at the thermal neutron guide H24
SI13 : Instrument for surface studies on ^3He-^4He mixtures.

For the simple reason that it is functioning in a regular manner, D10 received the least technical support available to the group. At the beginning of 1974 most of the effort was concentrated on the commissioning of IN3. Other work was devoted to SI13 and (as a sideline of this low-temperature activity) to the preparation of scattering experiments on ^3He (performed on IN5).

D10 – FOUR-CIRCLE DIFFRACTOMETER AT THE THERMAL GUIDE H24.
(W. Yelon)

D10 has been functioning on a regular basis for more than a year, and has been extremely successful in fulfilling the scheduled program. Operating only as a four-circle diffractometer (D10B) over the past year, it has been used for a large number of different problems. Making use of the cryostat, D10 has been used to investigate low temperature structural transitions (Dechlorodurene, Paraterphenyl), magnetic structures ($Fe_{1.1}Fe$, Fe_3O_4) and electronic transitions (Ti_4O_7, Fe_3O_4). With a stres applied inside the cryostat, the low-temperature phases of KCN have also been investigated. The high pressure structure of $FeCl_2$ was studied with a pressure cell at 6 kbars. In addition to several room-temperature crystallographic studies (AGS, $Cl_2Cr_2O_6$, Stilbite, etc.) neutron topography work was performed which provided significantly better resolution then previous studies.

During the past year, significant improvements have been made in the mechanics and the programming, improving the collection by 30%. The detector shielding has been improved and the background lowered. Several weeks of instrument tests have given the limits of suitability for the use of an analyzer for structural studies in terms of reduced background, etc. A test crystal of NH_4Cl was measured and compared with previous measurements on the same sample at Brookhaven, Argonne and Studsvik. The tests show that D10 has the best signal to background ratio of the instruments compared, the best resolution (FWHM) and is second to Brookhaven (60%) in peak intensity. The suitability of D10 for small sample studies suggested by this comparison was verified in the subsequent successful measurements of Ti_4O_7 and UCr_2O_6, each of which was smaller than $1 mm^3$.

IN3 – TRIPLE AXIS SPECTROMETER AT THE THERMAL GUIDE H24
(R. Scherm)

IN3 was opened for public use at Easter 1974. It ran successfully for six months as a classical triple axis machine.

Eight scheduled experiments were performed :

- phase transition $TbVO_4$
- magnons in K_2CuF_4
- linewidth studies $RbMnF_3$ and liquid Ga
- lattice dynamics of Se and Th.
- changes of phonons in Nb D, FeNi and irradiated Al.

INSTRUMENT PERFORMANCE

Monochromator	E_0	approx. flux	beam size
Graphite (bent)	20 meV	10^7 n/cm^2 sec	3 x 2 cm^2
Cu 111	35 meV	3 x 10^6 n/cm^{2}sec	3 x 5 cm^2

A multidetector (Kalus/Jacobé)has been in operation since August 1974. It consists of 24 individual ^{3}He detectors spanning a sensitive area 18cm wide and 12 cm high. Its efficiency is 70%.

1) It permits the instrument to be used as a «MARX» Spectrometer, a mode which up to now has not been very popular,
2) it nearly doubles the vertical divergence,
3) it allows the choice of the detector width after the experiment.

A permanent problem was the inadequate accuracy of positioning the angles. The optical system foreseen in the original design of IN3 for fine positioning has been further developed. It failed completely, due to the inadequate mechanics associated with it. Furthermore, the sample table does not allow heavy loads. Therefore a major rebuilding of the mechanics must be envisaged. For two months IN3 was used for its original purpose, the nonclassical mode : focussing with curved crystals. Thermal bending of CaF_2 (Schedler) crystals could be considerably improved. Radii of curvature as small as 6 meters have been obtained. However, another factor of 2 in crystal size as well as simpler heating/cooling techniques have still to be achieved to make thermal bent analyzers practical.

Curved composite mosaic crystals proved very valuable for small samples. We have built models by attaching small strips on curved surfaces :

a) A vertically bent monochromator (6 graphite strips glued on a cylindrical surface of 1.20 m radius) doubles the flux on the sample.
b) Horizontally bent analysers : fixed radius R = 3 metre Ge 220 analyser (8 strips glued on backings 8 x 8 cm^2).
c) Variable radius graphite analyser (15 strips glued on a stell-sheet, (which can be bent elastically) 18 x 9 cm^2).

First test experiments on Vanadium, as well as flat and sloping phonon branches, in small samples gave promising results.

Vanadium scans E_o = 14.8 meV			
Analyzer	flat graphite 2/3° collimator	Ge 220 R = 3m	Graphite R = 3m
Relat. Intensity	1	0.9	8
Resolution	0.28	0.09	0.25 Thz

SI13 – SURFACES STUDIES ON ^{3}He-^{4}He MIXTURES (R. Scherm)

This experiment is a joint project of the Low Temperature Lab CRTBT of the CNRS, Grenoble and the ILL. A dilution refrigerator was built at the CNRS. It was tested for extended periods in both the CNRS and the ILL. The cryostat works very well down to 70 mK.

The beam defining slit system is ready and the related electronics near to completion. Experiments can probably start in Spring 1975.

Coordinator : R. Scherm.

IN3 - Sample changing in progress.

instrument group 3
«time of flight»

This group covers the following instruments :

IN4 : Rotating Crystal spectrometer on the thermal tube H12
IN5 : Multi-chopper spectrometer on cold guide H16
IN7 : Mechanical statistical chopper spectrometer on thermal tube H5
S18 : Test assembly for electronic chopper on thermal guide H22.

IN4 – ROTATING CRYSTAL SPECTROMETER (W. Drexel)

The spectrometer has been operating continuously for the whole of 1974. Sixteen experiments in the scientific programme and 4 test experiments were carried out. No major modification has been made to the instrument itself, which has operated alternately with graphite and copper monochromators.
One experiment used stationary monochromators with a FERMI chopper supplied by GfK. This chopper has not yet been permanently installed.
The operation of the Nicole data acquisition system was twice interrupted : in April (internal fault) and in August (at the time of connection of PN1 to Nicole).
In addition, the instrument's own cryostat was modified and all of the 210 detectors are now in operation.

IN5 – MULTI-CHOPPER SPECTROMETER (F. Douchin and R. Lechner)

This instrument, mounted on the 'cold source' guide H16 started effective operation in January 1974 (when the 4th chopper became available). It is operating at present at 10,000 rpm with neutron wavelengths up to 10 A and an optimum elastic resolution of 20 μeV.
Under these conditions it has been possible to carry out the scientific programme with a satisfactory degree of instrument utilisation, in view of the installation work summarised below. The average life of ball-bearings has stabilised at about 3000 hours of continuous operation at 10,000 rpm. Changing a bearing represents 6 hours' work (shut down) followed by 48 hours' operation limited to 6000 rpm (running-in).

The reliability of the neutron detection and data acquisition system has been excellent, apart from the period of installation of the additional experiment PN1 with software incrementation.
During 1974, the experiment data processing programs have been developed on the ILL's PDP10 computer. A total of 28 experiments on IN5 have been completed, corresponding to 19 projects in the scientific programme plus 3 test experiments.

MAJOR WORK CARRIED OUT IN 1974

1. Neutron flight tube (70 m^3) filled with helium gas.
2. Second series of 200 He detectors started operation
   (present total 400, i.e. approx. 10% of the measuring area available).
3. Re-installation of the connection between the electronic counter detectors (improvement of reliability and ease of changing measuring angles).
4. The special cryostat for the experiment is now completely operational.
5. Improvement of the neutron shielding of the sample zone.
6. Ordering and delivery of 2 complete chopper systems necessary for testing and maintenance of the instrument.
7. Installation of CAMAC interface between IN5 and Nicole (hardware).

IN7 - MECHANICAL STATISTICAL CHOPPER SPECTROMETER (W. Drexel)

In 1974, the spectrometer IN7 was moved to permit the new polarised neutron spectrometer D3 to be installed on the same reactor beam tube. This opportunity was taken to reduce the distance between the chopper and the sample, which limits the scattering angle to 90° but increases the intensity by about 30%.
It has only been possible to use the spectrometer since the middle of September for two experiments in the scientific programme and two test experiments.

SI8 - INSTALLATION OF TEST FOR PRELIMINARY ELECTRONIC CHOPPER DESIGN. (C. Berthet)

In 1974 the development of this instrument was temporarily suspended and the staff transferred to other duties.
Continuation of this project depends on whether it is possible to obtain chopping monochromator crystals from other research centres (Oak Ridge National Laboratory).

During the first half of 1974 the test instrument was improved in several ways :
1) completion of a magnetic circuit with ferrite,
2) Helmholtz reel test with ferrite,
3) modification of safety systems.

A second monochromator crystal of nickel ferrite (composition: $Ni_{0.5}\ Fe_{2.5}\ O_4$ has also been successfully produced.

An overall test of the instrument was carried out on a vanadium sample leading to an energy resolution of 2%.
To obtain sufficient intensity it would be necessary to use a monochromator containing the nickel isotope 62.

Coordinator : F. DOUCHIN.

instrument group 4
«crystallographic instruments»

This group includes the following instruments :

D6 : Hedgehog-Diffractometer with 100 movable counters on the thermal guide H24
D8 : Four-circle instrument on the thermal beam tube H11
D9 : Four-circle instrument on the Hot-Source (beam-port H3)
D12 : Modified-Laue Film Method on the thermal guide H23
D15 : Four-circle instrument Mark VI on the inclined thermal tube IH4
D16 : Four-circle instrument Mark VI on the Cold Source (beam-port H16)
Li4 : Three-circle Siemens X-ray Diffractometer.

These instruments can be divided into two categories :

Operational instruments :	D6, D8, D12, D16, Li4
Instruments at the assembly or testing stage :	D15, D9

1 — THE OPERATIONAL INSTRUMENTS

D6 - THE HEDGEHOG DIFFRACTOMETER (B. Klar)

The performance of the program system, which is partially written in assembler (PDP11) and partially in FORTRAN (DEC 10), has been increased thus improving the positioning program, the data transfer between the two computers, and the data reduction procedure. A new curved copper monochromator has been completed by D. Hohlwein for D6. This monochromator gives better focussing (focal distance 1.75m) and a higher flux at the sample ($2.4 \times 10^6 n/cm^2 sec$) for a mean wavelength of 1.297 Å.

D8 - FOUR CIRCLE DIFFRACTOMETER (S.A. Mason)

This instrument was shut down from January until May 1974 for the construction of IN8. D8 was not routinely available until after the extended annual reactor shut-down in July. During the stoppage, more substantial shielding was installed around the detector. To support the new shielding and to allow the sample-detector to be varied (between 60 and 120 cm), an air-cushion has been placed under the modified detector arm. The collimators between monochromator and sample have been further modified and a beam tunnel may be mounted between sample and detector to reduce unwanted background. The background without sample is now typically 5 to 20 counts/minute and even at a scattering angle of 2^o in 2θ is not prohibitive.

A pyrolytic graphite monochromator has been tested (in reflection) and shows a large intensity gain over a Ge (1 1 1) monochromator in transmission with some loss of resolution.
A simple analyzer table can be installed between sample and detector.

In addition substantial work has been done on the development of a multidetector consisting of one dimensional position sensitive gas detectors for neutron protein crystallography.

D12 - NEUTRON FILM TECHNIQUES (D. Hohlwein)

For the modified Laue Technique, a mechanism which allows copper crystals to be bent very uniformly (cylindrically), without destroying the mosaic structure (up to radii of 1 m) has been developed. For D12, a copper monochromator has been bent with a radius of 2.7m. It gives for λ=1.3 Å a wavelength spread of 7% and a flux at the sample of 9.8×10^6 n/cm^2 sec.
Considerable work has been done on the development of the classical film techniques (Weissenberg and Precession) with neutrons. The results are so promising that it is proposed to install a second beam on D12 using the upper and lower part of the neutron guide for two monochromators ; one for the modified Laue technique and the other for the classical film technique.

D16 - FOUR CIRCLE DIFFRACTOMETER (S. Wilson)

This instrument has been working since January 1974, with a pyrolytic graphite monochromator (mosaic spread = 80'). The flux measured at the specimen is 4.8×10^6 n/cm^2 sec at 2.4 Å. At this wavelength, the $\lambda/2$ component is about 1% without a filter. A program modification now allows scans of the type ω,NΘ (with N of the same or opposite sign as ω) using the paper tape mode of input. There is also a PDP8 program which produces suitable input tapes from parameters displayed on the system television screen, and set up as required by the user.
The two cryostats which D16 will share with D15 have not yet arrived from Harwell.

Li4 - THREE CIRCLE X-RAY DIFFRACTOMETER (M. Thomas)

It was found necessary to redefine and then reconstruct certain parts of the low-temperature apparatus (flow of gaseous nitrogen) for this instrument, and some improvements have been made to the programming system.

2 – INSTRUMENTS UNDER CONSTRUCTION

D9 - FOUR CIRCLE DIFFRACTOMETER AT THE HOT SOURCE (M.S.Lehmann)

The construction of D9 was completed during 1974. The shielding surrounding the the monochromator and the beam path was assembled in April, and first neutron tests were carried out in May. These showed that the shielding intended for the monochromator housing of the neighboring IN6, as well as the wall between the two instruments were inadequate. As IN6 is not yet operational, it was decided to build a temporary additional shielding. A second test was carried out in October and the shielding was found satisfactory in November after a few small modifications. The cabling and tests of the electronics were finished in October and the diffractometer is now fully controllable by the CARINE computer system. Neutron crystallographic tests will be carried out in early 1975.

D15 - FOUR CIRCLE DIFFRACTOMETER ON THE INCLINED THERMAL TUBE IH4 (S. Wilson and M. Thomas)

The work of installing the shielding around the D15 monochromator started in October 1974. A first coarse alignment has already been made.

A tempory monochromator carrier is being made and will be installed before the end of the year. Its purpose will be to define the shielding elements missing (entry and exit collimators and beam-catcher) and also to test the efficiency of this shielding.

The Eulerian cradle controlled by the same computer (PDP8E) as D16 has already been tested at the same time as D16 with the assistance of a pulse generator simulating the neutron source. The tests were completely satisfactory.

Coordinator : M. Thomas

instrument group 5
«diffuse scattering»

This group includes the following instruments on the cold guide H15

IN10 : Backscattering spectrometer

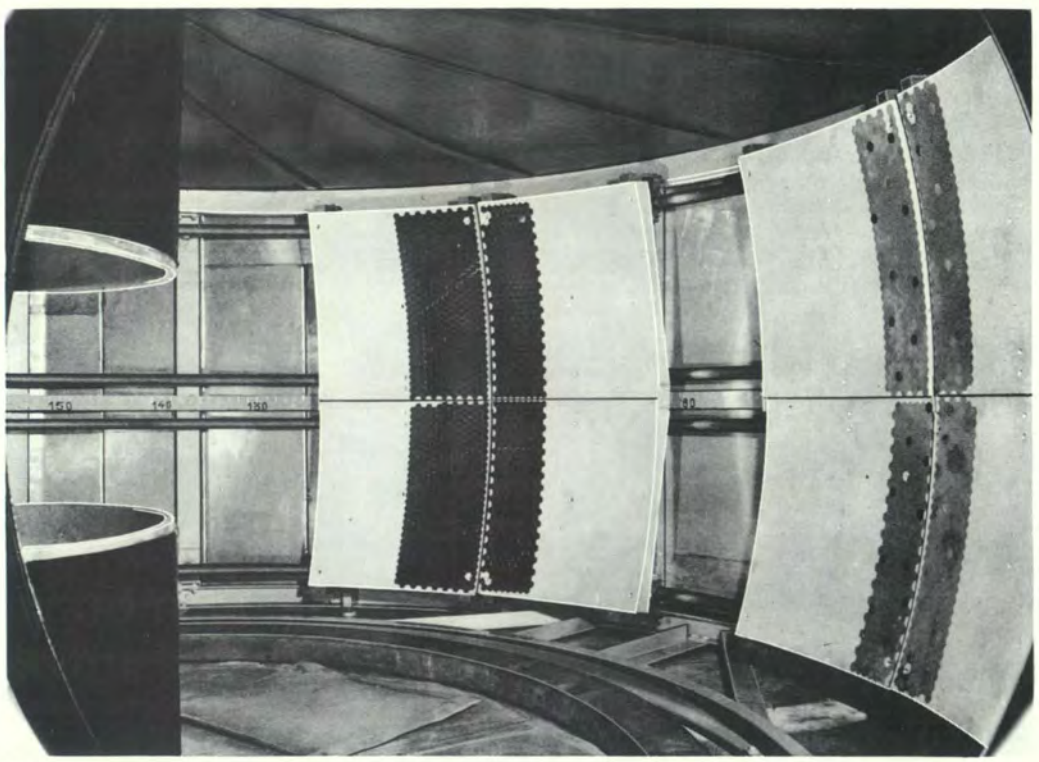
D11A : small angle scattering spectrometer

D7 : diffuse scattering spectrometer

D11B : small angle and diffuse scattering spectrometer

and

SI19 : «vortex» small angle diffractometer on the cold guide H18.



IN10 - Analyser

IN10 - BACKSCATTERING SPECTROMETER (A. Heidemann)

The instrument was commissioned in the first week of February 1974. New installations between February and December 1974 :

1. Rotating table of cryostats
2. Variable temperature helium cryostat
3. Variable temperature nitrogen cryostat
4. On-line visual display of the spectra.

The «temperature scan» project is progressing slowly. One furnace, the regulators and control units are already available. The second oven and the electronic interfaces are under construction. The PDP11 software has been improved and is now working very satisfactorily.

D11A - SMALL ANGLE SCATTERING SPECTROMETER (K. Ibel)

The most important step in the improvement of the instrument was the implementation of a new multidetector, now backed up by a logical device, which encodes the pulses with much higher certainty than before. A double chopper system has been developed and tested for inelastic experiments ; however, the problem of positioning the choppers is not yet fully solved. A study of a high speed velocity selector for variable resolution has been started. First tests have been done on a goniometer head with two independent axes for the computer controlled alignment of single crystals in vacuo. Further auxiliary equipment, which is now in routine operation, is a stopped flow apparatus for rapid mixing of solvents, and a specialized variable temperature cryostat with quartz windows. For chemical and biological preparations to be done near the instrument a cabin has been installed with a balance, a pH meter, a refrigerator, and a stock of glassware. A number of standard programs for data reduction and display have been written.

D7 - DIFFUSE SCATTERING APPARATUS (W. Just)

Improvements have been implemented such as new monochromator shielding around the beam repartition area of H15, and new shielding around the sample-detector area. An automatic sample changer for five samples (control of sample position and rotation) is now available. The generosity of Prof. T. Springer (KFA-Jülich) who left a vacuum sample container for our use is gratefully acknowledged. The preparations for the installation of polarized neutrons have been completed.

D11B - SMALL ANGLE AND DIFFUSE SCATTERING (G. Kostorz)

The new diffuse scattering bank will integrate with the small angle scattering instrument D11A to form a single apparatus. Major mechanical components and ancillary equipment, in particular a cryostat and a five-position sample changer, are in construction under the supervision of the Rutherford-Laboratory. The Rutherford part of the instrument is to be delivered to ILL in March 1975.

At ILL, the PDP11/40 computer with peripherall devices like the display system, disk drives, and card reader has been received, and software development is in progress, based on the DEC RSX 11D operating system. The computer will be dedicated to D11A and D11B and allow for more on-line data treatment and recall of previous runs. The data acquisition electronics for the D11B detector bank, control electronics, necessary hardware modification for D11A, and corresponding software have progressed according to schedule. The system is to be operational in June 1975. Work on the new platform and on modifications of the D11A vacuum system to accommodate D11B has begun.

SI19 - «VORTEX» SMALL ANGLE DIFFRACTOMETER (P. Thorel)

The SI19 apparatus is concerned with vortex studies in type II superconductors and is to be mounted on the H18 beam. It consists of a small angle scattering diffractometer (0.5 to 10°) measuring in the horizontal plane and utilizes long wavelength neutrons of 10 to 20 Å. The cryostat has quartz windows of 40 cm diameter and provides a magnetic field of 22 k Gauss by means of superconducting coil (the input current being 26 amps). The field can rotate with the sample around a vertical axis in steps of 0.01 degrees.

Tests have been made on the coil and these were satisfactory. However the cryostat had a leak on the helium temperature windows which the manufacturer is repairing. Machining on parts of the apparatus is almost completed and the setting up will start in early January, immediately after the conclusion of the Oak Ridge experiment.

Coordinator : M. Roth

instrument group 6
«powder spectrometers»

This group includes the following instruments :

D1A two axis high resolution diffractometer for powders and single crystals on thermal guide H22

D1B two-axis diffractometer with multidetector on thermal guide H22

D 2 two-axis high flux diffractometer for powders and single crystals on thermal guide H11

D 4 two-axis «liquid spectrometer» on the hot source (in this group from 9.8.74 on hot tube H8

D1A - TWO-AXIS HIGH RESOLUTION DIFFRACTOMETER FOR POWDERS AND SINGLE CRYSTALS (M. Steiner until 30.6.74, A. Hewat From 1.7.74)

This instrument has worked satisfactorily all the year. The background has been reduced ; the shielding of the Ge monochromator has been increased for neutrons and the adjacent neutron huide now has good protection. The flux at wavelength 1.5 Å is approximately what we can expect for a monochromator with 30% reflectivity. The measured resolution corresponds to the expected value for 1.5 Å

The present counter will be replaced by a bank of eight more efficient counters in 1975 : the effective intensity will be increased and the relative background will be reduced.

D1B - TWO-AXIS DIFFRACTOMETER WITH MULTIDETECTOR (P.Convert)

The instrument has been fully operational since March. The present graphite monochromator and filter (at 2.4 Å) have replaced the Ge one and gives a higher flux on the sample, 10^6 n/cm^2/s. A cryostat with a vanadium tail is available (2°K to 300°K). Its nitrogen shield is large enough to allow, with cadmium shields inside for neutrons, scattering angles from 5° to more than 120° without loss due to the material of the cryostat. The main disadvantage of the multicounter, only five points of measurement per degree, has been easily reduced by measuring 2, 3 or 4 times the same diagram with a rotation of the multicounter around the sample of $\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{4}$ of a cell between each count. So the shape of peaks can now be correctly analyzed. An experiment at small angles has shown that it is possible to measure starting from 0.5° ($K = 0.023$ Å^{-1}). In November-December, the old multicounter with its defects was replaced by a proportional one which has better efficiency and homogeneity.

D2 - TWO-AXIS HIGH FLUX DIFFRACTOMETER FOR POWDERS AND SINGLE CRYSTALS (P.Burlet until 30.9.74, C. Berthet from 1.10.74)

The instrument was stopped during the first half of the year (during the construction of IN8).

The counter has been replaced by a bank of four He^3 counters. A moving window allows the adjustment of the thermal beam to the size of the sample. The defects of the first experiments carried out with the bank of four counters are now solved. The interference between counters has been suppressed ; furthermore the background has been reduced. The furnace has been reconstructed using a vanadium resistor and can now reach 1000°C. Better monochromators (Cu and Ge) are envisaged to improve the quality and intensity of the monochromatic beam.

D4 - TWO-AXIS «LIQUID SPECTROMETER» ON THE HOT SOURCE (H.Egger)

Two major modifications were made in June-July 1974 :

1 -- Set for a second monochromator :

In addition to the normal Zn (002) monochromator, which gives a wavelength of 0.7 and 0.35 Å, a Cu (200) monochromator giving a wavelength of 0.5 Å was installed. Both monochromators are properly pre-aligned, so that one can switch from one to the other, in about one minute, without realigning them.

2 -- Modification of the driving unit of the counter arm :

In order to get rid of mechanical backlash and of difficulties with large moments of inertia of the long and heavy counter arm, a DC driving unit was installed directly below the counter. At the same time the spectrometer was pushed back about 80cm to make the full angular range up to 140° always available.

3 -- A precise slit system : This allows, in many experiments, the reduction of the background, especially at low angles. Another variable slit in front of the counter makes measurements with better resolution possible.

Coordinator : P. Convert

instrument group 7
«polarized neutrons»

This group includes the following instruments :

D5 Three-axis polarisation-analysis neutron spectrometer on hot beam H4

D3 Polarised neutron 2-axis diffractometer with tilting detector for normal-beam geometry on thermal beam H5.

INTRODUCTION

Numerous improvements of details have been carried out on D5 in 1974. D3, which arrived in July, has been installed under excellent conditions on the thermal beam tube H5, which it shares with IN7. D3 will be operational at the beginning of 1975 as planned. The supply of good polarising crystals (FeCo and Cu_2MnAl) is now assured and should allows us to obtain even higher neutron fluxes on the two instruments in 1975.

D5 - Three - axis spectrometer

D5 - THREE-AXIS POLARISATION ANALYSIS NEUTRON SPECTROMETER (J.Schweizer)

This instrument has been operational for more than 18 months and continues to give satisfaction. Because of the great variety of experiments for which it can be used, a number of improvements of detail have been made in 1974 and are listed here.

a) - Mechanical :

- Improvement of the analyser shielding
- Provision of a coil which provides a special configuration of the sample field for use in some polarization analysis experiments.
- Modification of the electro-magnet cradle to extend the range of cryostallographic orientations for the sample.
- New cryostat holder to facilitate adjustment of height and orientation of the cryostat.
- General sample table for use when the electro-magnet is not needed (this table will also be used for a new superconducting magnet and cryostat being provided for use on D3 and D5).
- Installation of a device to allow the counter to move out of the horizontal plane.
- Design study for a new collimation system.

b) - Cryogenics :

- Construction of apparatus to allow the helium cryostat to be used at liquid nitrogen temperature.

c) - Software :

Improvement of the computer control programs for D5 :

1. A modification of the Carine system by the Process Control Computer group allows program libraries to be set up on magnetic tape. This has practically solved our space problems, which became critical at the end of 1973.
2. It has been possible to standardise and improve the existing programs. Although time did not permit the completion of this work, the situation has much improved. Good documentation now exists which will make it easy to resume and complete the work.

D3 - POLARISED NEUTRON 2 AXIS DIFFRACTOMETER WITH TILTING DETECTOR FOR NORMAL-BEAM GEOMETRY (F. Tasset)

This instrument was delivered to ILL by Rutherford Laboratory in July 1974 and was immediately installed on beam tube H5. B. Forsyth, who designed this instrument, is working on the final commissioning. The main work has been on the control software for the diffractometer and on the radiofrequency flipping unit, since the rest of the experiment has functioned perfectly ever since it was installed. The instrument can now be considered as operational and should produce its first expermental results at the beginning of 1975.

Coordinator : F. Tasset

instrument group 8
«monochromators»

1 - INSTRUMENT DEVELOPMENT

Instruments allocated to the group :

D 13 A : Neutron double crystal diffractometer on thermal guide H24

LI 2 : X-ray double crystal diffractometer

LI 3 : Gamma diffractometer

In addition to these three instruments used for the characterisation of monochromator crystals and of samples to be studied on the ILL neutron spectrometers, an X-ray orientation device has been built up.

This allows large and heavy crystals to be orientated before being mounted on the neutron spectrometers or on crystal cutting and polishing machines.

This device permits also the assembling of composite monochromator systems on a simple two-circle diffractomerter equipped with a scintillation counter (A. Freund R. Hustache).

The instrument D 13 A proved in 1974 its utility and flexibility in many routine tests measuring the width and the reflectivity of monochromator and sample diffraction profiles. In addition it was used for assembling and testing of samples consisting of several smaller pieces. In collaboration with the CNRS X-ray Laboratory at Grenoble a neutron topographic technique has been developed. The design of the high resolution neutron diffractometer D 13 B was completed and this facility is now in construction (A.Boeuf, P.Detourbet, S.Lagomarsino, A.Rennert, F.Rustichelli) .

The mechanical part of the instrument LI 2 was improved and the electronic control was adapted to the NIM standard in order to prepare it for a more convenient automation and a data acquisition system allowing rapid data transfer to the computer. A solid state Si (Li) detector can be mounted on the diffractometer especially for measurements with X-rays from the white spectrum. (A. Freund, R. Hustache, N. Thillosen).

In conjunction with the firm Cristal-Tec at the CENG, a device for the hot-pressing of single crystals has been constructed for the Samma diffractometer LI 3. It is now possible to follow directly the change in the mosaic structure and the reflectivity as a function of the deformation parameters. Also in 1974 the perfection of many monochromator and sample crystals has been studied on LI 3 (J. Carcey (Cristal-Tec), A. Hartmann, J. Schneider).

In consequence of urgent needs crystal lapping and polishing machine, a diamond saw and a spark erosion cutting and planing machine have been bought and are being installed. An acid saw and an electropolishing machine are also available in this small laboratory for crystal preparation (A. Freund, R. Hustache).

2 - DEVELOPMENT OF MONOCHROMATOR MATERIALS

A systematic analysis of large monochromator crystals (hot-pressed Ge, Cu) showed that the relatively low overall reflectivity of these crystals is due to angular and spatial inhomogeneities of their mosaic structure (ILL Pub. 74F24 and 74S70). The γ-ray «in-beam» observation of the mosaic structure during the deformation process revealed that these inhomogeneities arise also from an inhomogeneous mosaic distribution before deformation. Therefore the effort has been concentrated on the growth of large single crystals, having a low and homogeneous mosaic spread. The unoriented growth of 60mm diameter crystal rods with about 1' mosaic spread using the soft mould technique was successful (A. Freund, J. Carcey (Cristal-Tec), R. Perrier de la Bathie (CNRS Grenoble)).

Whereas it is still impossible to grow large Cu (Ge) single crystals without a radial gradient in the lattice spacing, a set of smaller Cu (Ge) crystals ($8 \times 15 \times 50$ mm^3) of different lattice spacing have been produced and tested for a focusing monochromator system to be installed on IN 3 (A. Escoffier, R. Hustache, S. Lagomarsino).

A new and very promising monochromator material has been discovered at a routine test on the γ-diffractometer of a sample to be studied with neutrons : deuterated, Niobium. A subsequent systematic study showed that one can produce $Nb_{1-x}D_x$ crystals of very homogeneous mosaic structure, the mosaic spread can be varied with the concentration of D between 15' and 70'. With 1.8 Å neutrons reflected by the (110) planes (d= 2.33 Å) a peak reflectivity of 50% (Laue geometry) has been obtained at a FWHM of 40' and an effective thickness of 11mm. The transmission of 75% is nearly twice that of copper. (J. Schneider, N. Stump (TU Munich)).

3 - COMPOSITE SYSTEMS AND BENDING DEVICES

Several monochromator materials are available only as relatively small crystals of a few cm^3 ($Nb_{1-x}D_x$; Cu (Ge)) or with a mosaic structure which is homogeneous only in a limited volume of about the same size (Cu, Be, Ge). Therefore an orientation device has been designed on which composite monochromators can be assembled. This device will permit the production of singly or doubly curved monochromator systems of practically unlimited size. (A. Freund, G. Gobert, D. Néant).

Three different types of curved composite crystals systems have been constructed and tested on IN 3. The first consists of 5 pyrolytic graphite strips glued on a cylindrical surface of 1.20m radius and is used as vertically curved monochromator. The neutron flux at the sample was doubled as compared with a flat monochromator. The neutron flux at the sample made out of 8 Ge parallelepipeds 10mm wide which were glued on a cylindrical surface of 3m radius and mounted as a horizontally curved analyser. The most flexible analyser system has been obtained by fixing 15 graphite strips on an elastic plate which can be bent to radii between 1.50m and 10m. Whereas the Ge system improved the resolution by more than a factor two at the same intensity, the graphite analyser yielded an intensity gain of a factor 8 at the same resolution, all quantities compared with those measured with a flat graphite analyser. (E. Schedler, R. Scherm V. Wagner, G. Dolling).

For the instrument D 12 a device has been developed for bending copper crystals elastically and plastically with a radius of curvature down to 1m. The bent crystal reflects nearly homogeneously neutrons of a wavelength range 1.25 $\mathring{A} < \lambda < 1.35\ \mathring{A}$ with a mean reflectivity of about 30% (ILL Pub. 74H181). On the same device, a new Cu monochromator was produced for the instrument D 6 leading to an intensity increase of a factor two (D. Hohlwein, A. Freund).

4 - STUDIES OF DIFFRACTION IN IMPERFECT CRYSTALS

The diffraction properties of initially perfect Si crystals curved elastically to radii between ∞ and 25m by a microscopic technique were investigated. The ratio of neutron reflectivity between plane and curved Si crystals was measured as a function of the neutron wavelength. The experimental results were interpreted in terms of dynamical theory previously developed at ILL. (A.Boeuf, P. Detourbet, S. Lagomarsino, A. Rennert, F. Rustichelli).

The influence of inhomogeneities on the diffraction process in a large Cu crystal was studied computationally for the symmetric Laue geometry as a function of the scattered radiation on the basis of Darwin's extinction theory. Results of B. Dorner obtained with neutrons of 1.226 $\mathring{A}$ and 1.825 $\mathring{A}$ on the same sample could be fitted by model calculations based on the mosaic structure measured with 0.03 $\mathring{A}\lambda$ -rays only after assuming a certain amount of primary extinction (J. Schneider, ILL Pub. 74S70).

Coordinator : A. FREUND

nuclear physics instruments

This group includes the following instruments :

PN1 : mass separator for unslowed fission products on thermal guide H9
PN2 : beta spectrometer : BILL on the vertical beam tube V3
PN3 : curved crystal spectrometers : GAMS 1, 2, 3, and
PN4/PN4A : anti-Compton and pair spectrometers on through going tube H6/H7

PN1 - MASS SEPARATOR FOR UNSLOWED FISSION PRODUCTS : LOHENGRIN

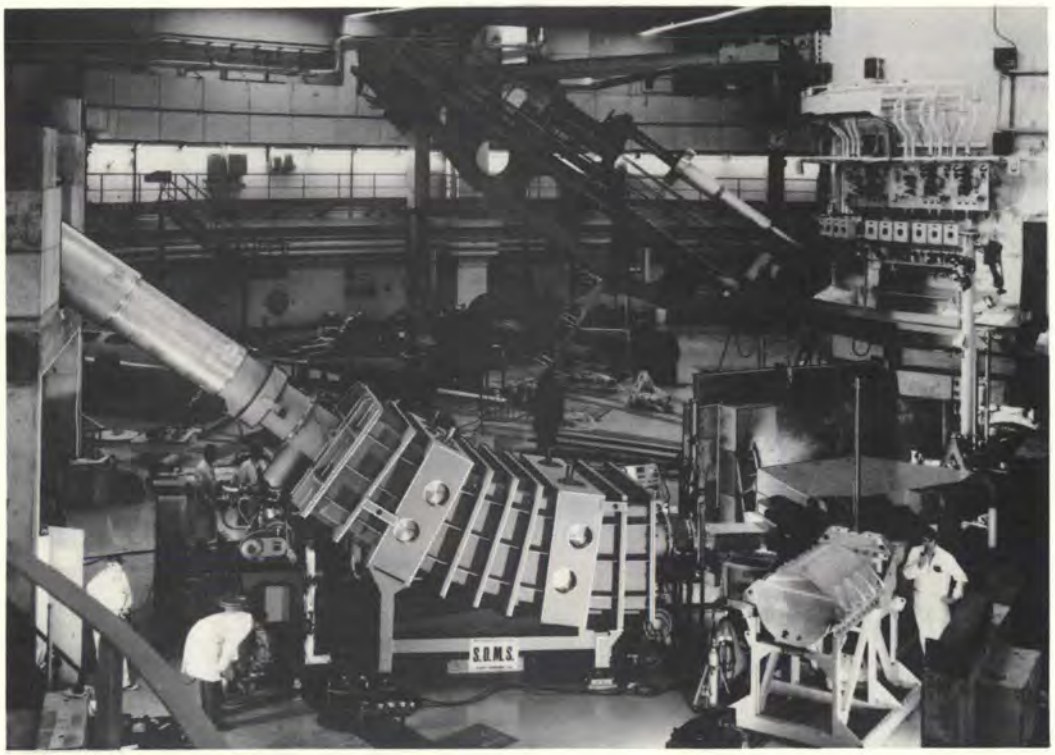
(H. Schrader)

In February 1974 the construction of the new target changing facility was completed consisting of a trolley with a titanium front part and an exchangeable diaphragm in front of the target. After introduction into the neutron beam tube several tests showed that the temperature by radiation heating stayed below 460 ^{0} C, and no deformation of the trolley could be observed.

The separator began functioning in March 1974 and continued running during the reactor cycles without any major breakdown. Different targets of 40 to 400 ug/cm^2 of UO_2 (93% of ^{235}U) evaporated by electron bombardment on metal backings have been irradiated in a thermal flux of 5 x 10^{14} neutrons/cm^2.s. Up to 10^5 fission products/s have been obtained behind the 72 cm long exit slit in the most abundant mass over ionic charge (A/q)-lines with a mass resolving power $A/\Delta A = 250$ (fw $\frac{1}{10}$). By reducing the luminosity of the instrument by a factor or 10 the mass resolution increases to A/Δ A 900 (fw $\frac{1}{10}$ m), where all masses in the light and in the heavy fission group are fully resolved. Continuing the efforts to very low luminosity a best value of $A/\Delta A \approx 15{,}000$ (fwhm) has been achieved.

By scanning the electro-magnetic fields several spectra of fission products have been recorded with surface barrier-detectors and the A/q-lines have been identified by analyzing the relative distances of the fields in the peak structure. This assignment was verified by measuring characteristic γ-spectra of some selected mass chains of fission products. The energy calibration of the instrument done in 1972 with an α-particle point source has been verified with a calibrated detector for fission products. The obtained energy resolution is better than 0.5%.

The data acquisition has been done by the on-line computer system «Nicole». The main program sections are now working, including a two-dimensional incrementation into a 64 K - disc memory and a field scanning program for the calibration of the instrument.



Lohengrin

PN2 - CONVERSION-ELECTRON SPECTROMETER «BILL» (W. Mampe)

In 1974 the demagnetizing unit (160A, 140V) working in a closed loop mode was completed, connected to the PDP11 and tested. The spectrometer was readjusted under the new and very reproductible remanence conditions of the two magnets which were made possible by this demagnetization. The parameters of the magnetic fields were determined between 80 keV and 6000 keV. The instrument became operational in July.

The performance of the spectrometer has proved to be even better than expected after a very careful adjustment and correction of the focussing errors : the momentum resolution for instance at 300 keV for a 3 mm x 120mm target was better than 2×10^{-4} (FWHM, target thickness included). This is the best performance ever achieved with an electron spectrometer concerning resolution, transmission and intensity. The resolution even for a very large target ($120 \times 40 mm^2$) is $\frac{\Delta p}{p} < 5 \times 10^{-4}$, this is about ten times better than under similar conditions with the Munich spectrometer ; this facilitates the data evaluation and gives a higher intensity and better energy precision. Furthermore electrons could be measured down to 15 keV and the intensity calibration was carried out with an Indium target. The minimal partial cross section for conversion at 100 keV is about 1m barn. These figures show that a large number of interesting isotopes can be studied with BILL for the first time.

The ten-fold proportional counter was adapted and tested ; using this the sensitivity of the spectrometer can be improved again by a factor of 2-3. All the fit and evaluation programs for the PDP10 have been established, and thus the whole measuring and evaluation process is ready for routine work.

Second International Symposium on neutron capture Gamma ray spectroscopy and related topics. Petten (1974) (in print).

PN3 - CURVED CRYSTAL SPECTROMETERS GAMS 1,2,3

(H. Börner and W.F. Davidson)

During the year all three curved crystal spectrometers have become fully operational. Since January 1974 GAMS 2 and 3 have been used for experiments, but with manual adjustments of the single channel analysers used to select the various diffraction orders. Since November 1974, the GAMS 2 and 3 spectrometers have been completely automated, viz : the windows on the photopeaks derived from the five measured diffraction orders are now set as function of γ-energy using the PDP-11 computer and a system for photopeak stabilization has been installed (similar to that of GAMS 1).

The currently available performance of the GAMS spectrometers can be briefly summarized (see H. Börner, P. Göttel, H.R. Koch, J. Pinston, R. Roussille and P. Van Assche, Contribution to the Second International Symposium on Neutron Capture, γ-Ray spectroscopy, Petten The Netherlands, September 1974 (in press)). For GAMS 1, the minimum partial cross section $\sigma_n \times I_{min}$ for $E_\gamma \sim 200$ keV measured with a 50mg source is about 1 mb, taken with a measuring time of 50 sec per angular setting. For GAMS 2 and 3, under similar operating conditions, $\sigma_n \times I_{min}$ is about 2 mb at $E_\gamma \sim 650$ keV. These sensitivities can obviously be further increased in the region of γ-lines of special interest by increasing the measuring period.

As regards energy precision, using a source whose thickness is <0.1 mm, it is possible to obtain an accuracy of < 0.1 eV on a strong γ-line at $E_\gamma \sim 100$ keV using GAMS and <2 eV for a strong γ-line at $E_\gamma \sim 500$ keV using GAMS 2 and 3.

PN4/PN4A - ANTI COMPTON AND PAIR SPECTROMETER (D. Heck)

The pair spectrometer was installed during the spring. As this instrument shares the γ-ray beam and the electronics with the anti-Compton spectrometers, these two instruments must be operated alternatively.

The pair spectrometer shows excellent energy resolution (4.3 keV at 7.6 meV γ-ray energy). Single-escape and full energy peaks are suppressed totally. The partial cross-sections of the weakest detectable lines are $<$ o.5 mb at 5 meV and $<$ 2 mb at 2.5 meV at 24 hours measuring time.

Last May, the anti-Compton spectrometer became inoperable due to an accidental warm up of the Ge (Li) detector. The repairs to the detector have not yet been successfully made. Moreover it will probably not be possible to achieve its previous specifications, even if it becomes operational again.

Coordinator : M. Asghar

H14-construction group

During 1974 installation commenced on a number of new instruments within a relatively small area at the north-west end of the guide-hall, on or near the cold guide H14 and the branched guides. To prevent problems of congestion in this area, the H14 Construction Group has been created to co-ordinate the installation of these instruments, comprising :

IN9 : Time-of-flight polarisation analysis spectrometer
IN11 : Spin-echo spectrometer
IN12 : Cold neutron three-axis spectrometer
D11B : Small angle and diffuse scattering spectrometer
SI 1 : Gamma asymmetry spectrometer

Since this is basically an administrative group, several of these instruments are also in a scientific co-ordination group. In particular, the report on D11B is given in Instrument Group 5, and further information on SI1 appears in the Nuclear Physics section.

IN9 - TIME-OF-FLIGHT POLARISATION ANALYSIS SPECTROMETER

(P. Seyfert)

Progress in the construction of this spectrometer has been achieved in three directions :

1)
It has finally been decided that IN9 will share the upper part of the H14 cold-neutron guide together with IN11. Because of the rather confined space available, the platform carrying all parts of the secondary spectrometer has had to be redesigned. This work is in a very advanced stage. The primary spectrometer (extended H14 guide, velocity selector and magnetic polarising mirror) will be common to IN9 and IN11 (see IN11 report below). The Mezei spin-flipper for IN9 and an additional neutron guide system providing the link between the IN11 primary spectrometer and IN9 are under design.

2)
Work on the data acquisition and storage system is well under way : the computer a PDP 11/20 shared with IN11, and its connexion to IN9 have been defined. Many of the hardware items (e.g., the time-of-flight unit) are ready.

3)

The performance of the polarised proton neutron polarising filter has been continuously improved during 1974. P. Roubeau and H. Glattli of the CEA Solid State Physics Department in Paris assisted in this work. The NMR monitor of the proton polarisation and the stabilisation of the static magnetic field are now fully designed and almost ready. The homogeneity of the static magnetic field was improved to better than 3 parts in 10^4 relative variation over the operating zone. The ^{4}He stage of the cryostat was modified to tolerate the relatively impure liquid helium in use at ILL, and it now allows a simpler and faster cooling-down procedure.

There are two remaining problems :

- Availability of large LMN single crystals. Tests are continuing with crystals loaned by G. Stapleton (RHEL) and M. Borghini (CERN) while a better «growing» system (as used at RHEL) is constructed at ILL.

- Improvement of the microwave cavity, which at present restricts polarisation to 60%. Re-design is continuing, but there is no straightforward solution to this problem.

We hope to have the new proton filter operational by April 1975, and a first test assembly of IN9 is planned for early summer.

IN11 - SPIN-ECHO SPECTROMETER (J. Hayter and F. Mezei)

Both IN9 and IN11 share the cold guide H141, installed in July 1974. Acceptance tests during August gave a satisfactory transmission of 64%, and installation of the velocity selector and shielding is now taking place. With the exception of the polarising mirrors (see below), the detailed design is complete, and the machine status is as follows :

MECHANICAL :

Most of the construction will take place at ILL. The major outside item is the central pivot, for which tenders have been received and whose delivery represents the longest delay (6 months). Construction of the primary spectrometer and the outer rail may proceed independently of the presence of this pivot.

ELECTRONICS :

The design and a large part of the construction are completed. Delivery has been taken of all main components, and final testing will be undertaken in March 1975.

COMPUTER :

The memory extension has been fitted to the PDP 11/20. Delivery of the disc and the software operating system will take place in January. The software for the CAMAC interface is being written at present.

POLARISING MIRRORS :

Final definition has been delayed to take advantage, if possible, of a new technique being developed at the Rutherford Laboratory ; this uses an evaporated polarising layer on very thin stretched plastic film.

Tests just completed at the ILL show that a short multi-mirror system may be possible for IN11, offering considerable saving in the magnetic circuit cost and weight. The decision on this, to be taken shortly, will not affect the planned completion date for the machine, namely september 1975.

Meanwhile, we have used the spin-echo technique in further test experiments to measure the central peak width in $SrTiO_3$, resolving a broadening of 0.4 μe V at Tc +1 K^0.

New guide tube on H14

SI1 - GAMMA ASYMMETRY SPECTROMETER

(P. Liaud and B. Vignon - ISN)

The installations and hardware for SI1 which are ready at this time are : the hydrogen cabin, the neutron guide and polariser, the Stern-Gerlach analyser, and the electronics of the experiment. The hydrogen target (a modified ILL helium cryostat) is complete, plumbing and monitoring excluded. The liquid scintillator counters and the beam guides inside the hydrogen zone are under construction.

Tests are scheduled to begin March 1st, 1975 , and the actual runs should occur during Summer.

IN12 - COLD NEUTRON THREE-AXIS SPECTROMETER

(W.G. Stirling)

This instrument still awaits budgetary clearance before construction can proceed. Nevertheless, some progress has been made.

1)

Guide H142 is in place and has specially designed supports in the IN12 area to allow the IN12 sample-table to move very close to the guide.

2)

Foundations for the «Tanzboden» have been prepared and a start has been made on laying the marble.

3)

Detailed plans for the mechanical parts are at present being drawn up.

4)

Preparations are under way to test the proposed worm-wheel central drive system.

5)

Curved graphite monochromator/analyser systems of the IN3/IN8 type are being carefully studied for possible adaptation to IN12

6)

D11B protection will be modified so that IN12 has the maximum possible clear space.

Coordinator : John Hayter

General view of neutron guide hall

development of new techniques

1 - ULTRA COLD NEUTRONS (UCN) (R. Golub, J.M. Pendlebury, A. Steyerl, P. Ageron)

This list represents the activity of this group in 1974 :

– The studies on Beryllium as a converter have been continued.

– Total cross section and scattering cross section on inhomogeneities have been measured at GARCHING at room and liquid nitrogen temperatures for various types of Beryllium (single crystals, cast and sintered polycrystals).

– Thermalisation (SUSSEX) and two-dimensional transport (ILL) calculations - taking into account the experimental cross sections and finite size of the converter have shown that the gain factor with Beryllium at 100°K is between 4 and 6.

– Studies on in-pile UCN guides :

- flux depressions due to a stainless steel guide have been measured (ILL)
- first UCN transmission measurements on short sections of polished stainless steel tubes have been made (GARCHING)
- a facility, selecting very cold neutrons from converters placed on a neutron beam has been tested at ILL. This allows : the measurement of transmission of full scale guide tubes and the gain factor of various converters at low temperature.
- a first design of the in-pile and out-of-pile parts of the UCN-facility with a room temperature converter has been made.

2 - POLARIZATION OF NEUTRONS BY REFLECTION ON MIRRORS (B. Hamelin)

Polarization measurements have been made with thin layers (about 1000 Å) of Cobalt and Permendur deposited by evaporation or by sputtering, on polished Titanium sheets or on stretched Mylar films (the latter fabricated at the Rutherford Laboratory).

The polarization is almost total at angles sufficiently large so that no reflection occurs on the substrate ; at smaller angles there was reflection on the substrate, thus decreasing the polarization for Mylar (with a positive scattering length) and for Titanium due to contamination of the surface before FeCo deposition.

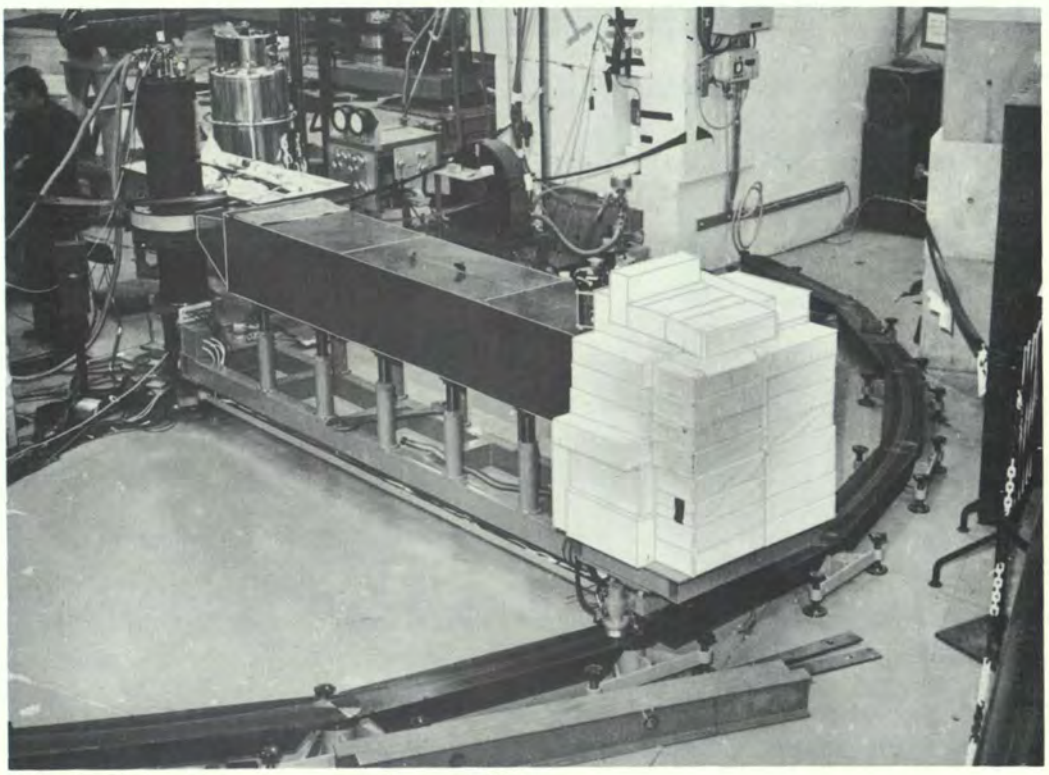
Mirrors made of successive deposits under vacuum of an antireflecting Ti, Gd layer and a Fe-Co layer are being made at CENG, and will be tested in early 1975.

3 - ENHANCED REFLECTION ON MULTILAYERS (P. Ageron)

Enhanced reflection on multiple pairs of layers (for instance Mn-Ge for monochromators, and Fe-Co for polarizing monochromators) may be obtained at angles larger than the total reflexion angles.

A code has been written for their simulation and good reflectivity and resolution have been calculated even for second or third orders of reflexion. Effects of random errors on thickness and of partial interdiffusion have been studied. First measurements on a rough multilayer made by Mezei also give encouraging results.

P. AGERON



IN7 Time - Of - flight spectrometer (see page 24)

colleges

INTRODUCTION

All the internal scientific activity of the Institut is grouped into «colleges» with particular scientific interests.

The following is the current list of colleges :

College 2	Theory Grenoble
College 3	Nuclear Physics
College 4	Excitations
College 5	Structures
College 6	Liquids, gaseous and amorphous materials
College 7	Imperfections
College 8/9	Physical Chemistry/Physical Bio-Chemistry

Each college has a secretary who is elected for a one year period and it is through the colleges that proposals are channelled to the Scientific Council.

In 1974 experimenters came to I.L.L. from these research centres or universities

college 2
«theory grenoble»

I - MEMBERS OF THE COLLEGE

Desclaux J.P.	
Desjonquères M.C.	Université de Rouen
Fischer K.	KfA Jülich
Fogedby H.	
Hinkelmann H.J.	
Hölzl K.	
Iche G.	
Kress W.*	
Kugler A.	
Lovesey S.	
Nozières P.	
Ranninger J.	
Rietschel H.	
Schmid C.	
Villain J.	
Dobrzynski L.	CNRS

II - VISITING SCIENTISTS

Castellani C.	Rome
Doniach S.	Stanford University
Gehring G.	Oxford
Loveluck J.	Westfield College
Sherrington D.	
Solyom J.	Central Research Institute Budapest
Suhl H.	La Jolla

III - SCIENTIFIC ACTIVITIES

During the last year, the composition of the College has changed markedly, and this evolution will continue in 1975. By the end of 1974, four theoreticians of the ILL staff have left, together with two from CNRS. In principle, four more will depart in the course of 1975. The remaining theoretical staff at the Institute being very few, recruitment of new members of the college becomes imperative. We are trying to achieve a balance between theoreticians directly concerned with specific problems studied experimentally at I.L.L. on the one hand, and on the other people with a broader interest who may help in keeping contact with the outside world. Unfortunately, finding appropriate candidates is not an easy task in the present context if one wants to maintain high standards of quality. Uncertainty on future employment makes it very difficult to find people willing to accept five year contracts. Various steps have been taken to find potential candidates, especially in the U.K. Yet, to a large extent, the trend will probably be toward short term contracts (one or two years) of more senior people who are on leave of absence from their home organisation. On top of this, we wish to continue our plans of short visits (a few months) from experienced physicists which has proved to be very stimulating to the College.

The links between College II and other Grenoble Laboratories have been expanded. The Institut maintains a weekly theoretical seminar which brings together most of the theorists of the Grenoble area, and which proves to be a stimulating forum.

Collaboration with the experimental colleges is less developed, and occurs mostly on an individual basis. An effort must certainly be made to integrate the theorists more in the general I.L.L. life.

Once again, it is somewhat difficult to classify the topics that have been studied in 1974. The work of Hölzl and Schmid on the dynamics of polymers has continued but that line of research will not survive the departure of its authors. A large efforts has been devoted to surfaces, whether electronic structure (M.C. Desjonquères and F. Cyrot-Lackmann), lattice vibrations and structure (Dobrzinski), or kinetics of adsorbed atoms (Iche and Nozières).

Heisenberg magnets remain an active subject because of the interest of I.L.L.experimentalists in that problem. Lovesey studied the dynamics of one dimensional chains, while Ranninger and Natoli pursued their work on magnon interactions.

The dynamics of classical liquids has been reviewed by Lovesey, who also applied the same methods to ^{4}He (lack of a collective mode in RPA above T_λ), and to ^{3}He (use of a Mori type approach to explain the recent results of Scherm et al. on neutron scattering by ^{3}He). Langevin equations «à la Mori» are in fact quite fashionable, as Ranninger used a similar approach to describe the central peak in A15 compounds.

Desclaux is conducting more quantitative work, dealing up until now with relativistic Hartree-Fock calculations, which he wants to expand into a full study of crystal field computation. Kress is performing sophisticated calculations of anharmonic effects in crystal lattices, in close connection with experimentalists.

Finally, there remains a standing interest in various Many-Body Problems : Kondo effect, one-dimensional metals (Fogedby, Nozières, Rietschel), critical phenomena, etc ...

Secretary : P. Nozières

Theoretical physics : the many body problem ?

college 3
«nuclear physics»

I - MEMBERS OF THE COLLEGE

Asghar M.	
Bailleul G.	
Blachot J.	CEN-Grenoble
Bocquet J.P.	CEN-Grenoble
Börner H.	
Braumandl F.	
Chauvin C.	CEN-Grenoble
Crançon J.	CEN-Grenoble
Crawford G.I.	Univ. Glasgow
Davidson W.F.	
Decker R.	Giessen
Do-Huu-Phuoc	IPN-Lyon
Dress W.B.	ORNL, Oak Ridge
Emsallem A.	IPN Lyon
Gautheron J.P.	CEN-Grenoble
Guet C.	CEN-Grenoble
Heck D.	GFK, Karlsruhe
Jeenicke E.	ISN Grenoble
Jeuch P.	
Larysz J.R.	
Liaud P.	ISN Grenoble
Mampe W.	
Monnand E.	CEN-Grenoble
Moussa A.	CEN-Grenoble
Pendlebury M.	Univ. Sussex
Perrin P.E.J.	CEN-Grenoble
Pfeiffer B.	Giessen
Pinston J.A.	
Ristori C.	CEN-Grenoble
Roussille R.	
Schrader R.	
Schreckenbach K.	
Schussler R.	CEN-Grenoble
Siegert G.	
Vignon B.	ISN Grenoble
Wollnik H.	Giessen

II - VISITING SCIENTISTS

Armbruster	GSI Darmstadt
Chery	IPN Lyon
Clerc	TH-Darmstadt
Emsallem	IPN Lyon
Ewald	University of Giessen
Fiedler	University of Giessen
Gizon	ISN Grenoble
Gizon Mme.	ISN Grenoble
Hall	University of Glasgow
Jungmann	TH-Darmstadt
Kellie	University of Glasgow
Koch	Jülich
Kratz	University of Mainz
Lang	TH-Darmstadt
Miller	Oak Ridge
Münnich	University of Braunschweig
Pferdekämper	TH-Darmstadt
Rudolph	University of Mainz
Schmidt	TH-Darmstadt
Sistemich	Jülich
Stippler	University of Braunschweig
Van Assche	Mol
Wohlfarth	TH-Darmstadt

– BEAM WORK

1. Neutron electric dipole moment (W.B. DRESS, P.D. MILLER (ORNL) ; P. PERRIN (CENG) ; N.F. RAMSEY (Harvard)

   Up to now the experimental data gave a value of :

   $|D| < 2 \times 10^{-24}$ e x cm

2. New experimental limit on T-invariance in polarized neutron β -decay (R.I. STEINBERG, V.W. HUGHES (Yale) ; P. LIAUD, B. VIGNON(ISNG)).

The triple correlation coefficient D that provides a test of T-invariance has been re-determined by studying the decay of polarized neutrons. Its new value is D = $(-1.1 \pm 1.7) \times 10^{-3}$ compared with the existing value of D= $(-1 \pm 1)\ 10^{-2}$.

3. Two-photon decay in n p capture (W.B. DRESS, P.D. MILLER (ORNL) ; G. GUET, P.PERRIN (CENG)).

Two 12 cm x 12 cm NaI (TI) crystals were used. A cross section value of 490 $\pm$80 b of two-photon decay in the γ -ray energy range of 600 to 1620 keV was determined. It is about 10 times higher than the predicted value.

4. (n_{th}, α)-reaction on medium and heavy nuclei (A. EMSALLEM, R.CHERY (Lyon) ; M. ASGHAR (ILL).

This experiment is being done on the thermal neutron guide H 22. So far the following nuclei have been studied :

^{95}Mo, ^{143}Nd, ^{145}Nd, ^{147}Sm, ^{149}Sm, ^{151}Eu, ^{153}Eu,
168,170,171,172,173,174, ^{176}Yb, ^{177}Hf, and ^{180}Hf.

The $(n_{th}, \gamma\ \alpha)$-reaction on ^{147}Sm, ^{149}Sm and ^{143}Nd was studied.

– LOHENGRIN

1. Ionization Chamber.

The resolution (FWHM) of the chamber containing Argon + 5% CO_2 was measured for fragments of chosen mass and kinetic energy. It was 2.1% for an energy loss of 55 meV in the sensitive volume of the chamber ; this resolution corresponds to a nuclear charge resolution $Z/\triangle Z$ (FWHM) of ≈ 33. Efforts continue to improve the resolution in order to be able to study the nuclear charge distribution in isobaric chains.

2. Independent yield measurement of ^{235}U fission products with a $\triangle E$ - Si surface barrier detector.

$A\triangle E$ - Si surface barrier detector (thickness 8μ) was used to measure directly the independent yields of the light fission fragment mass chains 85 to 103. The nuclear charge resolving power $\frac{Z}{\triangle Z}$ (FWHM) of 43 was achieved. It should be noted that it is the first time that neighbouring nuclear charges around 40 have been resolved.

3. High Mass Resolution of the Mass Spectrometer.

An effort was made to improve the mass resolving power of Lohengrin in order to be able to study directly the nuclear charge distribution and $Q\beta$ values in mass chains. The best value of $\frac{M}{\triangle M}$ (FWHM) up to now is $\approx 12000 \approx 8$ MeV.

4. a) Secondary-electron based system

The experiment was run to determine the number of secondary-electrons for fission fragments of chosen mass and kinetic energy. The aim was to study the charge distribution in isobaric chains. The nuclear charge resolving power achieved so far is $\frac{Z}{\triangle Z}$ (FWHM) ≈ 30.

b) Time-of-flight system for nuclear charge distribution.

Light fragments of chosen mass and kinetic energy were passed through a $\triangle E$ - carbon plate of 1.3 mg/cm^2 (160 foils). After this time-of-flight was done on the products coming out of this plate. A carbon foil gave the START signal and a total energy Si surface barrier detector placed at a distance of 80cm gave the STOP signal. The nuclear charge resolving power $Z/\triangle Z$ (FWHM) of 45 was obtained.

5. Search for and measurement of new delayed neutron activities.

A neutron detector and a (4π)-βdetector have been used simultaneously in this work. The data analysed up to now have led to three new half-lives, hence three new nuclei of ^{91}Se ($T_{1/2} = 0.27 \pm 0.05$ sec), ^{99}Sr (0.6 ± 0.21 sec), ^{138}Te (1.3 ± 0.3 sec). Four new delayed neutron precursors consisting of ^{91}Se, ^{94}Kr, ^{99}Sr, and ^{138}Te were found.

Six new Pn values corresponding to the precursors ^{91}Se (Pn = 21± 10%), ^{94}Kr (5.7 ± 2.2%), ^{99}Sr (3.4 ± 2.4%), ^{99} (1.2± 0.8%), ^{134}Sn (17± 13%) and ^{138}Te (6.3±2.1%) were determined.

6. a) Study of the β-n_d-γ phenomenon i.e. where the delayed neutron leaves the final nucleus in one, or more than one, excited states.

γ - n, n - γ and β - γ coincidence measurements were done on ^{85}As, ^{89}Br, ^{90}Br, ^{94}Rb and ^{135}Sb. Results show the existence β - n_d - γ decay mode. It is the first time that the existence of this β-n_d - γ phenomenon has been directly demonstrated.

b) Delayed neutron time-of-flight test run.

A time-of-flight was included in the above (a) work with a flight path of ≈ 20cm. A 30cm dia. by 2 . 5 cm NE 213 liquid scintillator was used.

The time resolution was≈5 n sec. The START signal was provided by a zig-zag beta-detector. In all the cases studied, one could see a reasonable neutron spectrum and these spectra were different for different nuclei.

7. E and $T_{1/2}$ measurements of fission products.

New information has been obtained on ^{90}Br, ^{96}Sr, ^{95}Rb, ^{96}Rb, ^{96}Y, ^{100}Zr, ^{133}Sb and ^{139}I.

8. Measurement of the He-jet transport efficiency.

The efficiency achieved was∼65% over a 4 to 5 hour period. It was reasonably stable. The capillary system has yet not been optimized for short (< 2 sec) half lives.

- (n,γ) AND (n,e$^-$) SPECTROSCOPY

During the year the curved crystal spectrometers GAMS 2 and 3, the pair spectrometer and the conversion electron spectrometer BILL became fully operational. It has been demonstrated that the combination of these six instruments (plus GAMS 1 and the anticompton spectrometer) at the high flux reactor in Grenoble constitutes a a very powerful tool for neutron capture spectroscopy. The main results are

1. Using all six instruments, it was possible to establish for the first time the decay structure of ^{100}Tc.

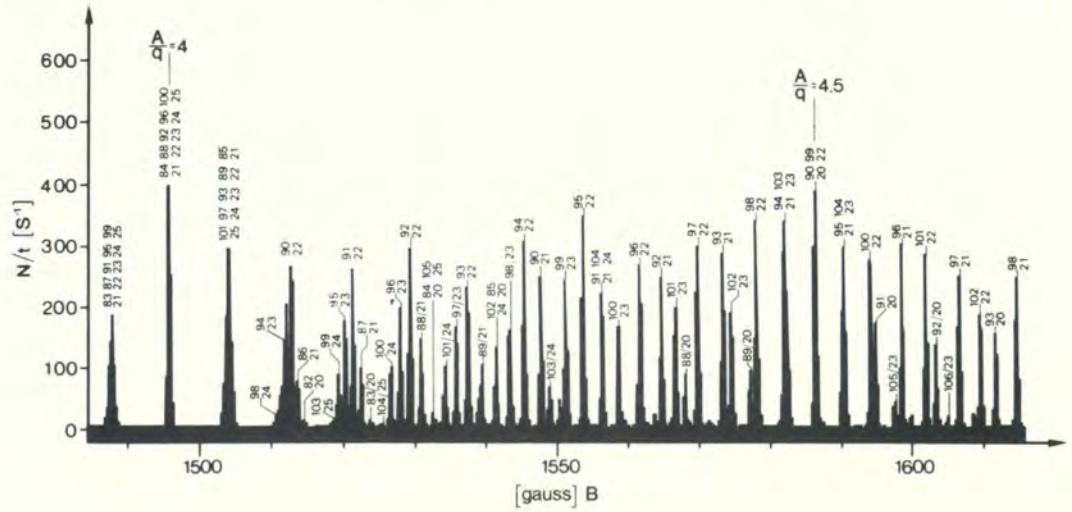
2. It was possible to establish the level scheme of ^{147}Nd up to 2000 keV and the level scheme of ^{149}Nd up to 600 keV. From these studies we learn that these two nuclei present a similar structure at low energy and in particular they do not show any rotational bands. We can conclude that the deformation increases rapidly between ^{149}Nd and ^{151}Nd.

3. In the investigation of the ^{238}U(n,γ) ^{239}U reaction 260 γ-ray lines in the E γ range of 15 to 1500 keV could be resolved with the curved crystal-spectrometers.

By studying the time-behaviour of the line intensities about 30 γ-rays could be attributed to ^{239}Np and ^{239}Pu formed after single and double β-decay of the ^{239}U compound nucleus.

Secretary : M. Asghar.

Spectrum of the recoil mass separator «Lohengrin» (PN1).
Light fission products. (High voltage : 460 KV, resolving power $\frac{M}{\Delta M} \approx 800$).



college 4
« excitations »

I - MEMBERS OF THE COLLEGE

Almairac R.	
Almeida Z.	University of Cambridge
Berthet C.	
Brown J.	
Castets A.	
Coey, J.	CNRS
Copley J.	
Currat R.	
Dianoux A.J.	
Dolling G.	Chalk River, Canada
Dorner B.	
Douchin G.	
Drexel W.	
Egger H.	
Fischer K.	KFA Jülich
Fogedby H.	
Ghosh R.	
Heidemann A.	
Iche G.	
Kress W.	Munich
Lechner R.E.	
Lovesey S.W.	
Meyer J.	
Nozières P.	
Nunes A.	
Parisot G.	
Ranninger J.	
Rietschel H.	
Rossat-Mignot	
Rustichelli F.	ISPRA
Schedler E.	
Scherm R.	
Smith H.	Oakridge
Stirling W.	
Teuchert W.	
Tocchetti D.	
Vettier C.	
Villain J.	CENG
Volino F.	
Wagner V.	Würzburg
Yelon W.B.	
Zaccai G.	
Ziebeck K.	

II - SCIENTIFIC ACTIVITIES

In the period January - July a total of 27 experiments from the College were completed. A further 22 experiments were started between July and November. The main fields of activity remain lattice dynamics, magnetic excitations and phase transitions. Within these fields low dimensional systems, metal insulator compounds and pressure effects in magnetic systems receive particular attention.

The distribution of completed experiments between the six inelastic scattering instruments is seen in the following table, which gives the total number of operating days per instrument and the percentage of these used by the College :

Instrument	Total operating time approved expt.(days)	% used by College 4
IN1	235.5	67
IN2	200.5	100
IN3	147.0	65
IN4	126.5	34
IN5	139.5	28
IN7	65.0	36
IN10	150.5	40

The instrument IN7 was not operational during this period because of the installation of a contiguous instrument.

The installation of the three axis instrument IN8 has been delayed by four months, and it is now expected to be operational early in 1975. IN12, which is to be installed on a cold neutron guide tube, has been postponed until 1975/76 because of lack of funds.

The demand for instrument time and its allocation by Subcommittee 4 on 10 October 1974 is summarized in the following table. The total time requested was 120 weeks, whereas the recommended allocation of time was 39 weeks. In the event the Subcommittee allocated a total of 37.5 weeks, broken down by instrument as follows (units of weeks) :

Instrument	Requested	Recommended	Allocated
IN1	31	9	8
IN2	62	12	12.5
IN3		12	10
IN4	5	-	-
IN5	5	2	3
IN7	2	-	-
IN10	15	4	4

The first observation of optical surface vibrational modes in the gap between the bulk acoustic and optical modes was made by Rieder and Drexel in a study of TiN. Inelastic measurements on bulk and crystalline samples of TiN were made in order to determine the surface modes. Such modes have in fact been predicted by several authors, and these new measurements should renew theoretical activity.

An acoustic phonon anomaly due to the Jahn-Teller phase transition in $TbVO_4$ at 33 K has been studied by Hutchings et al. At 154 K the phonon dispersion is normal, but as the temperature is lowered toward T_C a strong interaction with an exciton sets in. Moreover, a strong peak at zero energy transfer develops. The detailed properties of this new mode are a subject of current activity (for a review of the physical properties of the co-operative Jahn-Teller effect see, for example, Gehring Rept. Prog. Phys. 1974).

Lechner and Heidemann have completed a preliminary investigation of rotational diffusion in the plastic crystal, adamantane, using the backscattering instrument IN10. A complete separation of the elastic from the quasi-elastic scattering was achieved with the high resolution obtainable on IN10. The results obtained thus far suggest that the adamantane molecules are performing 90°-rotational jumps around the fourfold symmetry axis of the crystal.

The work of Vettier and Yelon on the magnetic properties of the metamagnet $FeCl_2$ at high pressures has produced some nex and exciting results. First, the magnons in $FeCl_2$ simulate a two-dimensional ferromagnet with large anisotropy at low temperatures at all pressures up to 4kb, despite a larger coupling between the hexagonal planes of ferrous ions in the high pressure phase. Second, exchange coupling within the planes is essentially independent of both pressure and temperature. However, the anisotropy gap increases by 25% between 0 and 4 kb. Finally, the collapse of the magnon scattering into a continuum seems to occur at lower temperature at 4 kb rather than at 1 kb. This result is in accord with a self-consistent, two magnon calculation (Lovesey, private communication). Future work on $FeCl_2$ will include a study of the magnon and phonon hybridisation as a function of applied magnetic field (Lawrence and Petitgrand, Phys. Rev. (1973) B8,2130).

The magnon dispersion in the metal-insulator compound NiS has been measured on IN1 Hutchings et al. Taken together with data collected at Harwell, the stiffness constant in the low temperature antiferromagnetic phase is found to be 465 meV Å, with an energy gap of some 12meV (for MnF_2,for example, the corresponding quantities are $\sim$ 3 meV Å and 1 meV, respectively). Future work will be concerned with the anisotropy in the dispersion relations, and the magnon renormalisation near the metal insulator transition temperature.

Secretary : S.W. Lovesey

college 5
«structures»

I - MEMBERS OF THE COLLEGE

Bartunik H.D.	T.U. München
Berthet C.	
Brown J.P.	
Combelas P.	CNRS Bordeaux
Convert P.	
De Novion C.	CEA Fontenay
Filhol A.	
Freund A.	
Forsyth J.B.	NBRU Rutherford Lab.
Fuess H.	
Hewat A.W.	
Hohlwein D.	
Klar B.	
Lehmann M.S.	
Mason S.A.	
Plant J.S.	Univ. of Sheffield
Radhakrishna	
Riekel C.	Univ. of München
Ronzaud D.	
Schneider J.R.	
Schweizer J.	CEN-Grenoble
Tasset F.	
Thomas M.	
Tranqui Duc	CNRS Grenoble
Wilson S.A.	AERE Harwell
Wolfers P.	
Wright A.F.	Univ. of Oxford
Yelon W.B.	
Ziebeck K.	

II - VISITING SCIENTISTS

Coppens P.	Univ. of Buffalo
Rasmussen S.E.	Univ. of Aarhus
Smith H.G.	Oak Ridge

III - SCIENTIFIC ACTIVITIES

In the period from January 1, to December 1, 1974 a total of 154 experiments have been completed within College 5. This total number subdivides according to the facilities allocated to the College as follows :

powder diffractometers	: 26 on D1A, 22 on D1B, 19 on D2
polarized diffractometer	: 20 on D5
single crystal diffractometers	: 12 on D8, 16 on D10, 16 on D16 2 on D6, 3 on D12, 15 on Li4

Nearly all the experiments performed within College 5 during 1974 concerned the utilisation of diffraction techniques for the determination of crystallographic and magnetic structures. This includes a wide range of scientific activity and specific investigations varied from the study of simple atomic structures to measurements on protein crystals or from the determination of basic constants to relations between physical effects and structural properties. In addition development of new methods has continued. People interested in the results of these experiments may be categorised into physicists interested in the dependence of structural changes on varying external conditions ; chemists interested in atomic or molecular structures, and, to some extent, biochemists and mineralogists.

In addition to the machines already mentioned in earlier annual reports the D1A high resolution powder diffractometer became available during 1974. This diffractometer has a resolution of $\Delta d/d = 2.10^{-3}$ and is therefore, when used in conjunction with the profile refinement method, a very powerful tool for investigations of fairly complex structures. Examples of the use of this diffractometer are studies on structural phase transitions in antiferroelectric $NaNbO_3$ and $NH_4H_2PO_4$. At about the same time the single crystal diffractometer D16 became operational and provides a facility with wavelengths > 2.2 Å. It is therefore well suited for studies on materials with large periodicities. A typical example for the use of this instrument was the investigation of superstructure lines and satellite reflections from feldspar phases with d-spacings of about 120 Å. It is hoped that these studies can elucidate the Si-Al distribution problem in feldspars. Promising results have also been obtained with the D 12 instrument, where the photographic recording of neutron diffraction patterns developed for the modified Laue method has been used successfully to obtain neutron Weissenberg and precession photographs. On this device screenless precession patterns of insulin single crystals have been produced which have a remarkably low background level.

As it is very difficult to survey all the scientific results obtained within College 5 during 1974, some typical results representative of groups of experiments will now be mentioned. Examples will be given for single crystal studies, for polarized neutron work, for applications directly related to solid state physics, and finally some words will be said concerning protein crystallography.

Due to the interest shown recently in TCNQ salts an attempt was made to elucidate the relationship between several physical properties of these crystals e.g. electric conductivity, specific heat, etc,. and the temperature dependence of their molecular structure. In this context a low temperature x-ray analysis of TEA-$(TCNQ)_2$ with about 3000 independent reflections has been made at the Institut and will soon be complemented by a corresponding neutron study. These investigations should permit a choice between different models proposed for the electrical conductivity of these organic compounds.

About 1000 independent neutron reflections have been measured on chromium hexacarbonyl $Cr(CO)_6$ at 78°K and were then refined to a final R-value of 2.9%. This neutron information is now being combined with the corresponding x-ray data in order to determine the electron densities. It is expected that these results will show an excess electron density around the transition metal as observed in a related compoubd studied recently.

Neutron diffraction data have been collected on a single crystal of an organometallic platinum compound with 196 atoms per molecule. This study was undertaken to determine the location of two H-atoms in the neighbourhood of the platinum atom, which would indicate an unusual hexacoordination of the metal. Data-processing is under way.

The paramagnetic scattering of polarized neutrons by CsO_2 and KO_2 has been investigated by polarisation analysis techniques on the polarized neutron diffractometer. The paramagnetic scattering arises from the unpaired spin of the superoxide ion and the polarisation analysis method is particularly advantageous for measuring the form factor of the magnetic electron since the spin-flip sacttering configuration measures only the paramagnetic and nuclear spin contributions. The data are currently being processed and analysed.

An earlier polarized neutron investigation of yttrium iron garnet YIG has been extended to 4.2 K. First data evaluation shows that the magnetic moments of the iron atoms in the two crystallographic sites are considerably lower than the free iron moment. This reduction has also been observed at room temperature and indicates covalency effects in an ionic compound.
Furthermore, the observed magnetic form factors for the two iron ions indicate a difference in the covalent bonding of iron in different environments.

A single crystal neutron study was made of the pressure dependence of the structure of $FeCl_2$. For this purpose 7 sets of 50 reflections were observed for pressures between 0 and 6 kbars, the pressure vessel being mounted in the Eulerian cradle. This is believed to be the first time that such an experiment has been performed. Data evaluation shows the pressure-induced rhombohedral/hexagonal phase transition and the pressure dependence of the chlorine position and the lattice parameters.

On the γ-ray diffractometer the ferroelectric-ferroelastic phase transition of KH_2PO_4 has been observed. The order parameter showed a thermodynamically unusual behaviour. In the paraelectric phase the measured integrated reflecting power increases significantly near the transition temperature.

The anomalous scattering of X-rays in copper has been studied in a wavelength range $0.30 < \lambda < 1.66$ Å. Values of $\Delta f''$ have been obtained from absorption measurements whereas $\Delta f'$ and f_o have been deduced from absolute integrated intensities from a perfect copper single crystal. The use of white radiation allowed the absorption edge to be approached within 1.2 eV, corresponding to $\Delta E/E = 1.7.10^{-4}$.

Preliminary work has been done in the field of protein crystallography, where obviously results cannot be obtained so rapidly. Feasibility measurements have been performed on crystals of orthorhombic lysozyme B, rhombohedric insulin and erythrocruorin, to examine the experimental conditions needed for protein data collection. Neutron diffraction measurements are under way in order to study the anomalous dispersion method on Gd, Sm, Cd compounds to enable an experimental determination of structure factor phases. This will later be extended to protein crystallography.

Secretary : B.Klar

college 6
«liquids,gases and amorphous materials»

I — MEMBERS OF THE COLLEGE

Bellissent R.	
Bletry J.H.	
Chieux P.	
Copley J.	
Cyrot-Lackmann F.	CNRS
Derrien J.	
Dianoux A.J.	
Douchin F.	
Drexel W.	
Egger H.	
Gaspard J.P.	
Ghosh R.	
Ermolieff A.	
Heidemann A.	Univ. of Munich
Hervet H.	Collège de France
Higgins J.	
Howells W.S.	
Knoll W.	
Lechner R.	
Lovesey S.	
Marti C.	
Ranninger J.	
Scherm R.	
Seyfert P.	
Stirling G.	NBRU
Volino F.	

II - VISITING SCIENTIST

Dolling G.	Chalk River

III - SCIENTIFIC ACTIVITIES

During the year 1974, almost all the spectrometers used by the College were operational (mainly D4,IN4,IN5,IN10,IN1) and consequently a great number of experiments could be performed. The corresponding data are now being processed and, in many cases, the final results are already known and published.

As in the past, the majority of the experiments dealt with structure determinations in the liquid and amorphous state, but a few important ones dealt with inelastic scattering in simple liquids and gases, and quasielastic scattering in molecular systems. These three items correspond to the three domains of activity of the College. Some examples of the experiments which have been performed are described below.

III-1 - STRUCTURE OF LIQUID AND AMORPHOUS SYSTEMS

The instrument most used for these kinds of study was the diffractometer D4 installed at the hot source. This apparatus was improved this year by the installation of a double monochromator-filter system which permits the use of incident wavelengths of 0.7, 0.5 and 0.3 Å.
Moreover, values of the momentum transfer down to 0.20 $Å^{-1}$ can be reached. All this allowed high quality results to be obtained.

III-1-1 - Molten salts

In the field of molten salts, Mme Dupuy (University of Lyon) and J.Y. Derrien have completed the determination of the three partial distribution functions in KCl using samples enriched with ^{35}Cl and ^{37}Cl. The main result is that, as in the solid state, each ion is surrounded, in average, by six ions of opposite sign, the great volume variation (about 20%) between solid and liquid states being due to a bigger distance between ions of same sign rather than to packing defects as was thought previously. From these results they tried to deduce the pair potentials. At the present stage, one can say that a «hard spheres» model fits the results badly and that logarithmic potentials seem to be better. Theys also began the study of CsCl and AgCl. First analysis show that, in fact, the results obtained with these three substances are quite different, especially AgCl which appears very «covalent». The importance of these measurements is emphasized since recent molecular dynamics calculations predict the existence of «optic modes» in molten salts. An experiment is scheduled on IN1 to verify such a prediction (J.R.D. Copley).

III-1-2 - Molten alloys

In the field of molten alloys, work has been done by H. Ruppersberg (University of Saarbrucken), M.C. Bellissent, J. Bletry, H. Egger, W. Knoll. Using relative concentrations such that the system behaves as a completely incoherent scatterer (zero alloys) H. Ruppersberg could obtain directly the near order parameter. In the case of LiPb, the data show clearly a preferred arrangement of the LiPb pairs. The other alloys studied were LiBa, LiAg, TiZr.

III-1-3 - Solutions

In the field of solutions, J.E. Enderby, R.A. Howe, G. Neilson (University of Leicester)and W.S.Howells proceeded with the study of NiCi in D_2O . However, due to great difficulties in preparing reliable samples, no definite conclusions can yet be drawn.

III-1-4 - Amorphous materials

In the field of the structure of amorphous materials J. Bletry could obtain the three partial pair interference functions in amorphous CoP, without performing isotopic substitutions and using only the magnetic properties. The instruments used were D_2, D_4 and D_5.

III-1-5 - Others

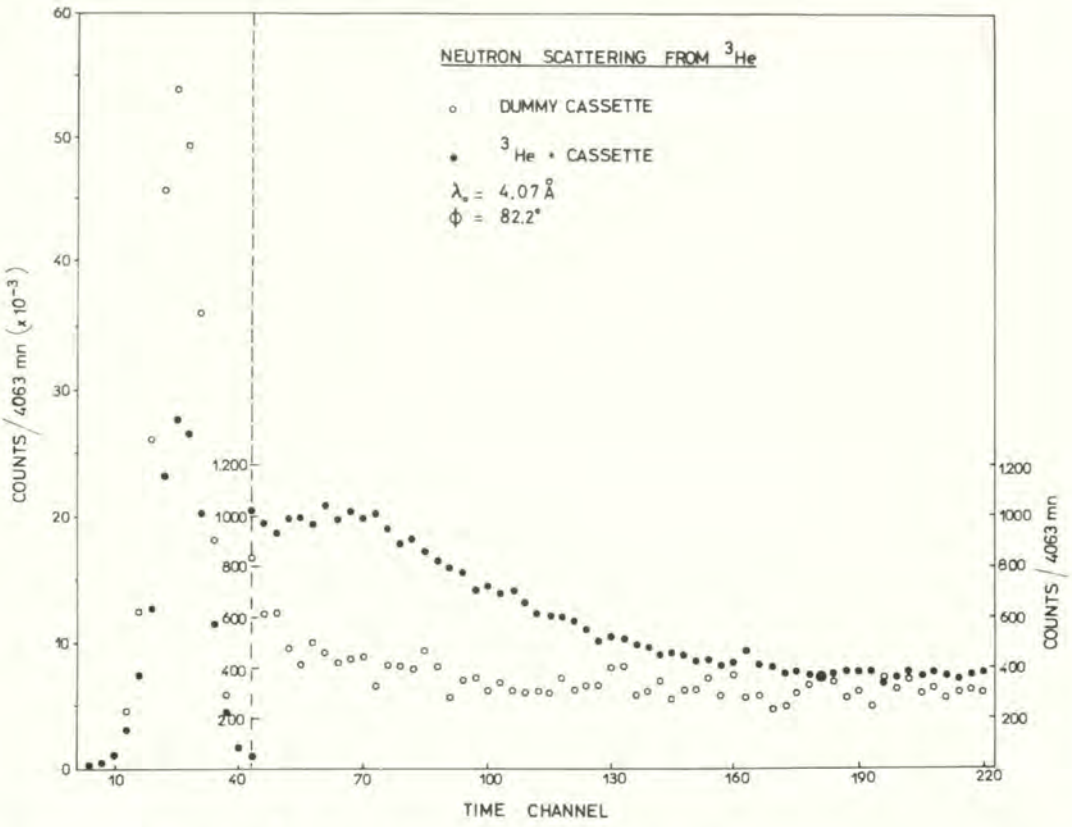
In addition, some experiments have been performed on the structure of simple liquids in a wide K range : D_2O (Clarke and Dore, Univ. of Kent), N_2 (Sinclair and Clarke), P (Dore and Clarke), tetrachlorides (Regis, Paris, and Parreins, Univ. de Montpellier), and the study of concentration fluctuations in non-metal transition range for lithium solutions in ND_3 have been completed (Chieux).

III-2 - INELASTIC STUDIES IN SIMPLE LIQUIDS AND GASES

III-2-1 - ^3He

Among the few experiments performed in this domain the most spectacular is certainly that one attempted successfully on helium 3 using IN5. (R. Scherm, W. Stirling (ILL) D. Woods (Chalk River) R. Cowley, R. Coombes (Edinburgh).

For the first time, it was possible to observe inelastic neutron scattering from liquid ^3He at 1.3°K. The main conclusions which could be drawn from this first experiment are the following : (i) for wavevectors between 1.75 and 2.1 Å , there is no evidence of the well defined excitation curve found in ^4He, (ii) there are marked deviations from a r.p.a. theory consistent with the zero and first moments, these deviations being in the direction of excess scattering at lower energy transfers and (iii) at the smallest wave-vectors 1.3-1.5 $Å^{-1}$, there is a broadened peak in the energy distributions at about 1 meV which is possibly a remnant of the zero-sound excitations.



IN 5 Spectra from liquid ^{3}He (T = 1. 3K)
(Scherm, Stirling, Woods, Cowley, Coombes)

The reasons for this success, after some negative attempts in other places in the world lie in the combination of a high flux, cold source reactor and a high intensity, low background spectrometer.

III-2-2 - Nitrogen gas

Another experiment was attempted on IN4 to measure the pressure dependence of dynamic structure factor of dense nitrogen gas, in order to obtain information on triplet correlation functions (P.A. Egelstaff, University of Guelph, W. Drexel). Good quality measurements were made at 5 pressures. The data are now being processed

III-2-3 - Liquid nitrogen

Finally, inelastic scattering from liquid nitrogen at high momentum and energy transfer was performed on IN1 (Sinclair and Clarke, University of Kent, Tocchetti). The main result is that for Q >10 Å^{-1}, the system behaves as a mono-atomic simple gas. Detailed analysis is going on for the spectra at lower Q (Q<10 Å^{-1}).

III-3 - QUASI-ELASTIC STUDIES IN MOLECULAR SYSTEMS

This year, the main work was performed in the study of random motions in liquid crystalline mesophases, using partially deuterated system in order to separate the motions of the various parts of the molecules. The apparatus used were IN5 and IN10.

III-3-1 - Smectic H phases

Using these two instruments simultaneously, H. Hervet (College de France), A.J. Dianoux, R.E. Lechner and F. Volino performed experiments on the smectic H phase of TBBA. The main result is that in this phase, the molecules perform a uniaxial rotational motions around their main axis, with a correlation time of 1.5×10^{-11} sec, in contradiction with arguments based on symmetry considerations which predict no rotation, and with a recent molecular theory wich predicts orientational order of the molecule. The butyl chains are found to perform rapid and rather large amplitude motions suggesting «melting» of these chains on the H phase In the solid phase, the terminal methyl and methylene groups are found to be rapidly rotating. The data on smectic C and A phases are being processed.

Using IN10 and in collaboration with J. Doucet (Orsay), measurement of self diffusion constants have been attempted on a smectic H mono-domain of TBBA. This diffusion is found to be very small $\approx 10^{-8}$ cm^2/sec and relatively anisotropic. However, some experiments have to be repeated to reach definite conclusion.

III-3-2 - Nematic phases

On IN5, experiments on the nematic phase of PAA, using two complementary deuterated samples (on the phenyl ring and on the methoxy group), have been performed on aligned samples.

In parallel, A.J. Leadbetter, F.P. Temme and R.A. Richardson (University of Bristol) have performed similar experiments on room temperature nematics (mainly diphenyls). One important result is that in this case the diffusion is anisotropic, as expected, but its value is small very : a few 10^{-7} cm^2/sec.

III-3-3 - Lyotropic systems

Finally, A.F. Dianoux performed some experiments on the various phases of potassium laurate heavy water (a water-soap system) using IN5. Preliminary results show that the spectra in the lamellar and micellar exhibit only slight differences.

III-3-4 - Normal Liquids

In the domain of liquids, P.N. Brier (University of Cambridge) has begun experiments on CH_2Cl_2 using IN5 and A. Heidemann has performed experiments on glycerol using IN 10.

Secretary : F. Volino

college 7
«imperfections»

I - MEMBERS OF THE COLLEGE

Bletry J.	
Burlet P.	CEN-Grenoble
Desvismes N.	PCBT CEN-Grenoble
Drexel W.	
Dubbers D.	Univ. of Heidelberg
Fischer K.	KFA Jülich
Freund A.	
Goeltz G.	
Grupp M.	Univ. of Heidelberg
Hayter J.	
Ibel K.	
Iche G.	
Jeandey C.	
Just W.	
Kostorz G.	
Livet F.	
Lovesey S.	
Marti C.	
Mathieu J.P.	CMA CEN-Grenoble
Meardon B.	SRC
Mezei F.	
Murani A.	
Nozières P.	
Parisot G.	
Pataud P.	
Radhakrishna P.	
Roth M.	
Roth S.	SNCI CNRS
Rustichelli F.	ISPRA
Schneider Jochen	
Schweizer Jacques	CENG
Stirling W.	
Stöckmann H.J.	Univ. of Heidelberg
Tasset F.	
Thorel P.	
Villain J.	CEN-Grenoble
Wagner V.	Univ. Würzborg
Wright A.	Univ. Oxford

II - VISITING SCIENTISTS

Fender B.	Univ. Oxford
Jaccarino V.	Univ. California

III - SCIENTIFIC ACTIVITIES

Two major meetings were sponsored by this college this year : The first one, a discussion meeting on Al alloys organized by G. Kostorz, was held in Chamrousse in March and succeeded in gathering metallurgists and neutron physicists to discuss the present understanding of the decomposition of Al-alloys, the different techniques which can be applied for their study, and possible directions for future activities, especially intercomparison of X-ray and neutron results. In October a workshop on crystalline electric fields in rare earth compounds was organized by W. Drexel and held at the ILL.

The experimental work around the instruments went on satisfactorily. 7 proposals on magnetic impurities were carried out, 2 on crystalline electric field effects, 5 on various metallurgical problems, 5 on magnetic inelastic scattering and 4 ont the physics of hydrogen in metals.

Radhakrishna and Livet studied the influence of Ti impurities in Ni (Ni-$Ti_{2\%}$) confirming a widespread loss of magnetization in the Ni-matrix (D5). The magnetic form factor of the Heusler alloy Pd_2 Mn Sn was measured on D5 at 4.2 K yielding results which can be explained in terms of a calculated Mn form factor, suggesting that the moment on the Pd atoms is very small. (Ishikawa, Tajima, Radhakrishna). The spin wave stiffness coefficient for the systems Pt$(Ni)_{45\%}$ and Pf$(Ni)_{50\%}$ have been extracted from small angle scattering measurements (Radhakrishna, Pataud) on D11. These represent the first direct measurements of D in these alloys ; the results compare reasonably well with those extracted from high field magnetization experiments. The interaction between conduction electrons impurity spin was demonstrated in a feasibility study on the system Cu(Fe) with an iron concentration as low as 0.2% (Löwenhaupt, Just) on D7.

Some recent measurements on the spin glass alloy system Cu-Mn with 5% Mn (Murani, Göltz, Ibel) have revealed a small peak in the scattered intensity for extremely low q values at the spin glass freezing temperature of the alloy. Although different in character from the critical scattering peak obtained for ferromagnets the result provides the first neutron scattering evidence of a «sharp» magnetic transition in a disordered alloy, in agreement with earlier findings of Mössbauer effect and low field a.c. susceptibility measurements.

The spin wave spectrum of Cu_2Al Mn was investigated for the $[\xi 00]$ $[0\xi\xi]$ and $[\xi\xi\xi]$ directions. In the $[\xi 00]$ and $[\xi\xi\xi]$ directions spin waves were observed up to the zone boundaries whereas no such excitations were found in the $[\xi\xi 0]$ direction above 65 meV (Ishikawa, Tajima, Stringfellow) on IN1. On the mixed antiferromagnet Ni_{1-x} Co_x 0 a study of the magnetic excitations revealed two well defined branches within the energy range of the magnon band of pure NiO corresponding to the spin fluctuations of Ni and Co respectively at the zone boundary in $[\xi\xi\xi]$. The results were analyzed within a molecular field model showing J_2 (Ni-Co) as the dominating interaction with a value which is very close to the geometric mean of the exchange in NiO and CoO (Wagner, IN1).

The studies of hyperfine interactions were continued on the back-scattering spectrometer (IN10) with V_2O_3 doped with Cr_2O_3. Integrated intensity, width and energy of the hyperfine peak are strongly dependent on Cr_2O_3 concentration and temperature (Heidemann).

Measurements of crystalline electric fields in systems $Er_{0.2}\ Y_{0.8}Ag$, etc. and Ho Rh, Er Rh, etc. gave a wealth of excellent data which stimulated theoretical work to calculate CEF parameters microscopically by means of band structure calculations (Knorr, Drexel) on IN7 and IN4.

Dislocations in Ni and Fe single crystals give rise to anisotropic magnetic small angle scattering. The analysis of these spectra allowed ont to distinguish edge and screw dislocations in different glide planes in good agreement with theory. The collaboration with the University of Reading (Messaloras, Stewart ; and Kostorz, ILL) on the study of Al-alloys continued with the study of aging problems on Al-Zn,, Al-Mg-Si and Al-Si (D11). To establish the exact positions of tie-lines in Al-Mg-Zn alloys measurements were undertaken on D11 on a series of such alloys (Gerold, MPI Stuttgart, Kostorz).

The growing interest in the behaviour of hydrogen in metals was reflected in a large number of experiments. Thanks to the high intensity and low background on IN4 measurements on Pd (H) and Pd (D) systems could be performed down to concentrations of 0.2 % which means that diffusion coefficients which are free of hydrogen-hydrogen interactions can be determined (Kley, Ross, Drexel). The Debye-Waller factor of H in Ta was measured on D7, showing an anomalous behaviour at high temperatures as was already found for Nb: This anomaly suggests the existence of an excited state of the proton which spreads out to next interstitial sites (Heim, Lottner, Just).

On the β-decay NMR spectrometer diamagnetic point defects in CaF_2, which are created by (n γ) -recoil, were studied. The electric field gradient of the defect, as well as the defect positions relative to the ^{20}F nuclei, could be determined from the well resolved quadrupolar splitting of the ^{20}F-NMR line (Heidelberg group, S16).

The spin-echo spectrometer whose arrival in its final form (IN11) is expected for next year, already gives interesting results on its experimental set-up. Mezei and Hayter succeeded in measuring for the first time the energy width of the central peak in Sr Ti O_3. They observed a full width at half height of 4×10^{-7} eV at 1°K above T_c

Secretary : W. Just

college 8/9
«physical chemistry/physical biochemistry»

I - MEMBERS OF THE COLLEGE

Bartunik H.
Chieux P.
Combelas P. Univ. Bordeaux
Dianoux A.
Duée E.
Fuess H.
Gilmore D. MRC Cambridge
Ghosh R.
Hayter J.
Higgins J.
Haas J.
Ibel K.
Jacrot B. returned from leave
Lajzerowicz J. University of Grenoble
Lehmann M.
Mason S.
Mathieu J.P. ILL & DRF CENG
Neumaier T.
Nunes A.
Osborne H.
Riekel C.
Rustichelli F. ISPRA
Schmidt G.
Stirling G. ILL & NBRU
Zaccai G.

II - VISITING SCIENTISTS

Peticolas W. University of Oregon

III - SCIENTIFIC ACTIVITIES

The scientific activities of colleges 8 and 9 can be divided into five main categories :

1) Crystallography of macromolecules
2) Small angle scattering from biological samples
3) Small angle scattering from macromolecules
4) Quasi elastic scattering from polymers, liquid crystals and other molecular systems
5) Molecular dynamics (e.g. H-bond spectroscopy)

1 - CRYSTALLOGRAPHY

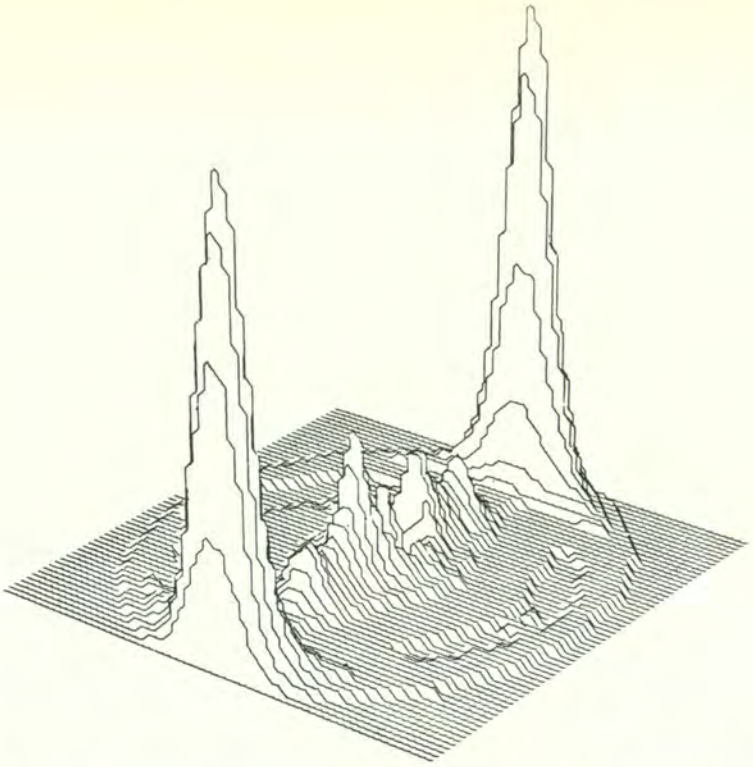
There has been a continuing effort in the development and use of instruments designed for structure determination in biological materials. Experiments on Zn-insulin and on protein structure using the method of anomalous dispersion have continued using the D8 four circle diffractometer (Mason, Fuess, Bartunik). It is hoped that the «hot» source diffractometer D9 will reach completion during the coming year (Lehmann) (see also the College 5 report).

Some preliminary experiments modifying the D16 four circle diffractometer with the introduction of Soller-slit collimators, so that it may be used for low angle diffraction, have shown promising results (Wilson, Zaccai).

2 - SMALL ANGLE SCATTERING FROM BIOLOGICAL SAMPLES

A large part of College 8 experiments come into this category. It includes diffraction from large structures, small angle scattering for overall size and shape determination, and preliminary measurements of H - D exchange rates using the fast data collection rate to make measurements less than 1 second apart (Haas).

10 experiments have been completed over the year, usually in several parts to allow feed-back to the experimentalist from the results. Samples have included muscle (London) (from frogs imported live from Britain) collagen (Oxford) human plasma (Gif) ribosomes and polymerase (Munich) viruses (Jacrot). Of particular interest are the results obtained by Bradbury et aL. (Portsmouth). These used the contrast variation technique to investigate the way DNA and proteins combine to form the basic structural unit of chromatin. It is already clear that the neutron results make a major contribution to the solution of this problem, one of the most important unsolved problems in biology. A preliminary paper is in press, and the experiments on D11 will continue.



3 dimensional diffraction pattern of frog's sciatic nerve on D11 (D. Worcester Harwell and K. Ibel, ILL)

3 - SMALL ANGLE SCATTERING FROM SYNTHETIC POLYMERS AND NETWORKS

A large part of the work of College 9 is again concentrated on the D11 apparatus for structural and conformational studies. Groups at Saclay, Strasbourg, Mainz and Manchester have been working on the conformation of polymer chains in solution, in the amorphous state and cross-linked in gels and membranes. Work is starting on marked polymers in the crystalline state. Following their preliminary results confirming the the unperturbed dimensions of polymer chains inthe amorphous state, (several papers in press), the groups have continued to co-ordinate their research programmes at a meeting held at Jülich in June this year.

Work on copolymers in solution using mixtures of deuterated and normal solvents shows the expected variation of the apparent radius ofgyration with the solvent-copolymer contrast. There is some preliminary evidence of segregation. In gels and networks the conformation of the chains themselves, or the arrangement of cross link points tagged with deuterium, has been investigated in non-equilibrium conditions such as swelling or stretching.

In the context of 2 and 3, the installation of the new multidetector on D11 in November is of interest. With a factor 3 increase in sensitivity, it gives not only a much improved signal to noise ratio, but a stable response which allows sensible correction of the cell sensitivity using vanadium or water runs. This is particularly important for biological samples which may have very weak diffraction patterns.

The extreme pressure on D11 has led to a proposal for a new instrument, D17 which will work in the higher Q-range of the present instrument and will prove of particular interest for biological samples.

4 - QUASI ELASTIC SCATTERING

Early this year the back-scattering spectrometer IN10 was commissioned. With its resolution of 1 μev (or even .25 μev in certain conditions) the machine is very important for measurements of rotational and diffusive motion in polymers (Manchester , Saclay) and liquid crystals (Oxford, Bristol, Jülich).

During this year the multichopper time-of-flight spectrometer IN5 has been in continuous operation. Its present Q-range is from 0.06 $Å^{-1}$ to 4 $Å^{-1}$ with a best resolution of 25 μev. IN5 and IN10 are complementary machines and a number of experiments have made use of this. Neutron scattering from chemical reactions, from liquid crystals (Oxford) and from polymers in solution (Saclay, Manchester) has been measured on both machines and the results correlated. It is clear that this will be an expanding experimental field.

5 - MOLECULAR SPECTROSCOPY

This topic is very much in its initial stages at ILL. Use of the IN4 rotating crystal spectrometer is important here and preliminary experiments are underway to investigate dynamics of ammonium ions in host lattices and of hydrogen in alkali halides (Durham). Measurements have been started on IN5 of the frequency distribution of hydrogen in niobium and vanadium.

This is another expanding field of interest and the commissioning of a Be-filter detector arm for the IN1 hot source triple axis spectrometer which is due to take place this year will be of considerable importance.

Over the year increasing numbers of experiments have been proposed and accepted by colleges 8 and 9 and performed at the Institut, indicating an increasing interest in the use of neutrons to investigate biological and chemical problems. In October, a Chemistry Day of Information was held at the Institut in order to discuss and explain results obtained in the fields of molecular spectroscopy, quasi-elastic scattering and small angle scattering. The sub-committee asked that a similar meeting with a more general participation be held next October.

The increasing interest in biological and chemical applications of neutrons spectroscopy coming from outside has been matched by recruitment of scientists within the ILL.

Secretary : J. Higgins

technical services

SCIENTIFIC SUPPORT	Construction and Maintenance Electronics Project Office
TECHNICAL SUPPORT	General Safety Radioprotection Workshops, maintenance and fittings
	Sample environment section Instrument operation section.

MECHANICAL CONSTRUCTION AND MAINTENANCE SECTION

The work of the Section falls under four sectors :

Design studies and industrial manufacture
Assembly and testing
Installation
Maintenance

Tests and Maintenance are developing more and more rapidly, and the Section has been reorganised so as to be able to respond efficiently and quickly to requests for repairs, loans of equipment, measurements and checks. Maintenance in various forms now accounts for 55% of the work of the Section.

Work of particular interest includes :

(1) Conversion of D4, D7, D8, D11A
(2) Completion of D9, D16
(3) Special equipment for IN2, IN5, D2
(4) Development of new instruments :
    design stage : IN12, SI16, SI19, ultra cold neutron source
    early construction stage : IN11
    installation stage : IN8, D15, SI1, SI13

(5) Study of the possibilities of construction, modification or installation of D11B, D13B, IN9, D12
(6) Major maintenance work on IN1, IN3, IN4, IN7, IN10, PN1, D5, D6, SI12
(7) Installation of 2 neutron guides on H14 (75 m and 45 m)
(8) Technology : Study of possible improvements to ensure greater reliability of instruments, particularly for crystal orientation systems and for the dynamic support conditions of selectors and choppers.
(9) Assistance and loan of equipment primarily in the field of vibration and temperature measurement and visual checking processes.

Work was done on a total of 42 experimental instruments during the year.
The section also assisted the Reactor, Safety/Radioprotection, Electronics and Sample Environment sections.

Since the establishment of ILL, the Section has acted as main contractor for 30 instruments.

ELECTRONICS CONSTRUCTIONS AND MAINTENANCE SECTION

1. PDP-11 GROUP

This year the PDP-11 group has had a variety of work, including planning for the connection of new experiments to a PDP-11, the preparation of interfaces and control electronics, the development and installation of extensions to experiments already operating, and the maintenance of systems in operation.

During 1974 the PDP-11 group completed and installed the D3 interface.
A duplicate of the D14 interfaces was tested, which controls an X-ray equivalent of D14 at Cambridge (X-rays).

A major extension of PN2 has been the automation of the demagnetisation system . The cycle, which lasts about 2 hours, includes about 20 phases and permits a residual field of less than 0.1 gauss to be obtained with a reproductibility of the order of 1 %.

The PDP-11 group has been working on the IN9 and IN11 projects which are in the test phase. The IN11 hardware should be delivered in March 1975.

A test bed which can be used by all the experiments connected to PDP-11s is in the course of installation. This test bed will also permit one experiment in a system (e.g. PN2-PN3 or IN9-IN11) to be isolated for diagnosis or for installation of an extension. When the test bed is operational, an experiment will only be stopped for a few minutes by a computer or interface fault.

2. CARINE GROUP

Tests an initiation of experiments D9, IN8.
Development and automation of the demagnetisation of the β spectrometer BILL.
Absolute angular coder prototype 36.000 points/rotation.
Maintenance on the 10 experiments connected to the CARINE system.

3. NICOLE GROUP

Installation of the electronics for kinetic measurements on D11 (stop/flow apparatus).
Development of new electronics for D11A and B for connection of a PDP-11.

a) external memory usable as multi-channel analyser and data concentrator.
b) time of flight unit
c) CAMAC interface for connection of a PDP-11 to a standardised CAMAC branch.

Further development of PN1 (LOHENGRIN)

a) automatic magnetic field scattering
b) double coincidence measurement for 64 K spectrum width.

4. DETECTOR GROUP

Installation of new proportional multicounters (D11A and D1B) to replace direct collection equipment.

a) Development of low-resolution resistive-wire position sensitive detectors.
b) Preliminary studies of small modular multicounters which are filled with He3 at high pressure for use on the D4 diffractometer.
c) Construction of a monitor detector (diameter $\approx$150mm) and of position sensitive monitors for beam plotting.
d) Design of low background aluminium detector for experiment D11B.

Design and construction of new high-speed logic for linear (D1B) and two-dimensional (D11A) multidetectors.

Final commissioning of experiment IN5 (400 He3 detectors).

PROJECT OFFICE

The Project Office was formed towards the end of 1973 and has contributed to :

1. The setting up of a follow-up and control system for expenditure on new projects and major modifications to existing instruments.
2. The technical coordination during the installation of new projects, thus minimising the nuisance caused by this installation work to adjacent instruments already in use.

In 1974 this technical and budgetary control covered mainly the following projects :

(1) - completion of the time-of-flight spectrometer IN5 and the diffuse scattering instrument D7.

(2) - installation of the D3 and particularly the D15 Mark-VI diffractometers, D15 being the first instrument to use an inclined beam.

(3) - installation of the D9 diffractometer on the hot source and installation of the 3-axis spectrometer IN8.

(4) - completion of layout plans for D11B (the instrument itself being constructed in UK)

(5) - continuation of studies and start of construction of the Spin Echo spectrometer IN11 on the new cold guide H14.

(6) - initial studies and tests for the installation of a fission products source for tripartition studies on IH1.

(7) - general preparation of the H141 and H142 guide area where the instruments IN9, IN11, IN12 and the polarising guide SI1 will be installed in 1975.

(8) - the project office is also assisting with the development of the small angle scattering instrument D17 and the ultra cold neutron source.

Budget Planning : Project OFFICE and Science Board

technical services
technical support

GENERAL SAFETY

1. Commission Interne de Sûreté (CIS)
   Study of the safety of experimental instruments involving considerable risks (e.g. H6, H9, SI1, IN2, high-pressure experiments)

   Safety study for proposed modifications, e.g. recompression of D2, N2 purging circuit, disposal of detritiation effluents via the 50 m chimney.

2. Design and implementation of safety facilities :
   provision of glove box for handling radioactive sources, recovery of active effluents from the surface treatment section, installation of electro-valves on the CH4 supply for tritium detectors, etc...

3. Extension of remote control alarm system :
   Centralisation of alarms in control room, separation of different alarms, extension of fire and malfunction detectors.

4. Maintenance and periodic testing of hydrogen detectors: Modifications to automatic operation of D2 leak detectors in detritiation.

5. Checking and maintenance of firefighting equipment : liaison with C E N G emergency services, training staff, planning for emergencies.

6. Miscellaneous : measurements of nuisance, noice, vibrations, etc.
   coordination with official organisations on compulsory checks (electrical installations, lifting equipment, pressure devices).
   control of individual safety equipment and of materials subject to regulation (alcohols).

RADIOPROTECTION

1. Laboratory work :
   Daily D_2O analysis for reactor and detritiation.
   Analysis of liquid and gas specimens. Tritium checks on urine and atmosphere.

2. Dosimetry of staff and environment : 4900 films distributed (1100 to external personnel), 780 environment dosimeter films in various buildings.

3. Analysis of liquid and gaseous effluents before disposal for monthly report liaison with SPEE for site security.

4. Supervision of solid and liquid radioactive waste before transfer to CEA for treatment.

5. Organisation of a one day information seminar on «Radiation and Radioprotection» in conjunction with the Training Office. About 150 people attended this meeting.

PRODUCTION, FITTINGS AND MAINTENANCE

a) - MAIN WORKSHOPS

The workshops carried out approximately 9100 hours of work, including 270 major requests for work, divided as follows : 20 for the Reactor, 50 various for general needs, 200 for the Mechanical Construction and Maintenance Section and the physicists.

A number of interesting mechanical engineering jobs may be mentioned :
furnace for IN10 ($1000^{o}C/10^{-3}$ Torr), speed selector modular discs on air bearing, collimator unit for D2, motorised goniometer with 3 indexable positions for IN1, connecting vacuum chambers for choppers for the D11 guide line, 15^{o} tilting table and motorisation of the magnet for, D5 prototype of vacuum-tight bearing for improving the reliability of the high speed choppers.

As in the past the workshops had a predominance of small jobs (less than 20 hours), to modify or adapt items used in experiments. These jobs, which cannot be prepared or programmed in advance, represent 80% of the work load of the workshops, and as they generally take priority, it is not always possible for work of technical interest to be handled by the workshop.

b) - SELF-SERVICE WORKSHOP

This workshop, equipped with 3 lathes and 3 milling machines of medium quality, permits technicians and experimenters to do minor machining work and small production jobs themselves with the assistance of a mechanic with skills in several trades. This workshop was used by an average of 10 employees for approximately 34 hours per day, the equivalent of 5 full-time employees.

c) - VARIOUS WORKSHOPS

For shielding requirements around the experiments the following work has been done :
production of 700 m2 of flexible panels of polyéthelene or boron carbide ; production by compaction of 30 panels of enriched lithium fluoride , boron carbide painting of 6000 thin supports for neutron collimators ; filling the shielding with paraffin, lead boron carbide or polyethylene.

The production section has also continued to take responsibility for the control and operation of the general raw materials metals store including supplying the dimensions requested by the users.

FITTINGS AND MAINTENANCE

During the year 150 major requests for work and 800 requests for handling jobs were dealt with. There was a considerable increase in handling, transport and minor work of all kinds, also a large increase in urgent requests for connection of equipment on experiments.

SAMPLE ENVIRONMENT SECTION

1. – VACUUM

1.1. - PUMPS

– Regular maintenance of 230 pump units including 30 secondary groups and 20 special groups : roots, turbo-molecular pumps.
– 63 repairs on seriously damaged pumps.
– Construction and installation in level B of a specialised cell for the repair of seriously contamined pumps.
– 150 loans of primary pumps.
– 100 loans of secondary pump groups.

1.2. - VACUUM TESTS

– A 4th Helitest started operation
– 7 Helitest repairs
– 450 tests for users outside the section
– Final test of installation for tritium storage

2. – CRYOGENIC LIQUIDS

2.1. - LIQUID NITROGEN

Consumption : 226,099 litres at 0.38 F/litre.

It should be noted that the consumption of liquid nitrogen has approximately doubled each year since 1972.

2.2. - LIQUID HELIUM

Consumption from 4.1.74 to 31.12.74	:	27,300 l
Minimum weekly consumption	:	61 l
Average weekly consumption	:	525 l
Maximum weekly consumption	:	925 l
Gas recovered	:	17,852 m^3
Gas lost	:	2,362 m^3 (11.68%)

It should be noted that 13.67% of the gas recovered was not returned to CENG but was made available to ILL users in the form of 'self-service' helium.

3. – CRYOSTATS

The 13 cryostats ordered from Messrs. Stoehr were supplied at intervals during the year.

Operating satisfactorily :

– 6 fixed-temperature cryostats (4 helium, 2 nitrogen)

– 1 variable temperature cryostat
  1.7 K to 100 K for IN10

– 1 He_3 cryostat used on IN3 and IN5.

Six month's intensive work by the scientist concerned and his team were necessary to prepare this last cryostat for operation.

Five variable temperature cryostats supplied in November are not yet operational : the variable temperature units require replacing (work in progress).

The He_3/He_4 dilution cryostats supplied by CNRS operated at 0.06 K in February 1974.

After a considerable delay, due to lack of staff, work was resumed on this apparatus in December. The temperature obtained in unfavourable conditions (vibrations) was 0.080 K (guarantee 0.10K). Long-term operation tests are in progress.

On 31 December 1974 the number of cryostats in operation was 27, including special equipment.

With 2 exceptions, all the requests for the loan of cryostats have been satisfied. Finally numerous repairs of improvements have been made during the year to existing cryostats, considerably improving performance (building time, response time, reliability etc . . .)

INSTRUMENT OPERATION SECTION

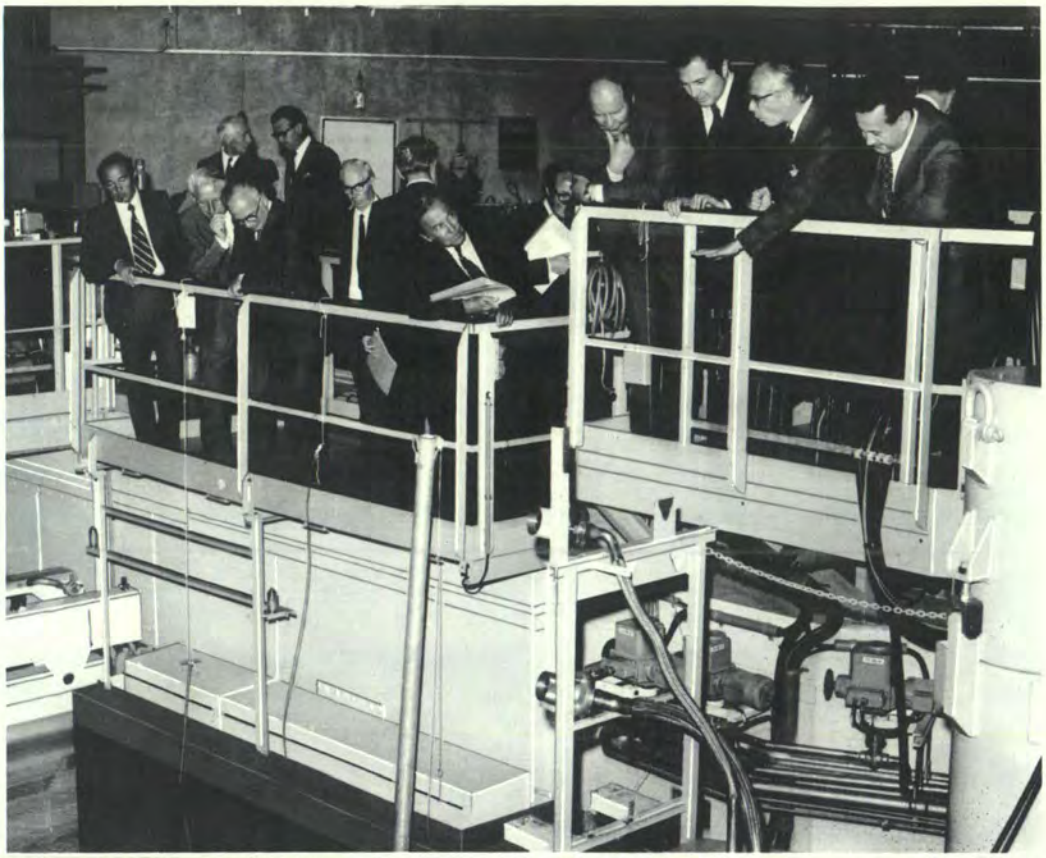
This group, composed of engineers and technicians concerned with the technical support necessary for the instruments in service, has been strengthened. A new organisation has been introduced taking account of the growing number of these instruments.

The structure of the instrument groups themselves has been maintained ; and coordinators now have at their disposal the manpower and means necessary for the smooth operation of the group.

A new group headed by Mr. Wheeler) has been started concerned with the following technical problems common to the instruments in routine use :

1. Training of technicians
2. Allocation of technicians between instrument groups
3. Contact with the Technical Services
4. General technical problems, such as changing over of cooling conditions to the new intermediate reactor circuit.
5. Improvement of the conditions of maintenance and security
6. Assistance to instrument «Responsibles» and experimenters.

reactor operation



Visit to the reactor «swimming-pool» - 19July 1974 The British Assistant Director Dr. W.M. Lomer explains the reactor mechanics to the French and British Ministers.

REACTOR OPERATION IN 1974

1974 is the second year of normal operation of the Reactor. The planned schedule was slightly modified as a result of a series of technical incidents during July and August.

ACTUAL TIMETABLE

Cycles N18 and N19 : 3 January to 19 February
Two scrams occurred (incorrect operation on D_2O purification circuit and electronic incident on the control rod).

Cycles N20 and N21 : 25 February to 11 April
Included a 24-hour strike and the failure of a DRG pump in the heavy water circuit.

Cycles N22 and N23 : 19 April to 3 June
No incident
The annual shutdown, originally planned for 3/6 to 1/7/74, had to be extended to repair a water leak on one of the control rod seals.

Cycle N24 : 4 July to 22 July
Interrupted by 2 48-hour shutdowns (unlatching of B54 and emergency work on the only DRG pump still in operation). During this cycle a failure of the start-up source (19/7/74) resulted in contamination of the «swimming pool» water with antimony 124, but did not cause a reactor shutdown.

Cycle N25 : Start-up : 24 July. Interrupted on 5 August as a result of control rod B54 unlatching several times. The intervention work necessary on this control rod continued until 20 August. This work took longer than normal because of the antimony contamination of the «swimming pool».

Cycles N26 and N27 : No incident of note.

Cycles N28 : Scram (and shutdown from 27 to 30 October)on shutdown of the Cold Source (electronic failure on a pressure pick-up). The end of the cycle was postponed until 2 November.

Cycle N29 : 8 November to 29 November
Power reduced twice to 45 MW (main pump stopped, due to failure of a temperature pick-up, from 9 to 13 November, and strike from 19 to 20 November).

CONCLUSION : The following figures indicate the position :
6 elements consumed from 1 January to 31 December 1974 ie. 365 days ; 14469 MW days divided as follows :
- 250 days at 57 MW and 5 days at 45 MW (69% of total)
- 88 days of scheduled shutdown
- 22 days of unscheduled and not recovered shutdowns
- (6% of total)

One must mention here that the greater part of the 22 days of unplanned shutdown was the result of the problem mentioned in Cycle 24, concerning the starting source for the Reactor. This incident (rupture of the steel casing of one of the two antimony «pencils») was caused by a cooling fault which has since been remedied. There were 2 main consequences of this.

1. - Significant contamination of the di-ionised water swimming pool and, consequently, the Reactor operating area. This contamination was progressively reduced during the second half of the year using the «in-pool» ion exchange columns, which are normally used for di-ionisation of the pool water. The incident was handled with routine equipment and in particular had no effect on the experimental programme.

2. - Weak contamination, for a few hours on 12 September 1974, of some of the ground outside the Institut where the CENG tanker was waiting to remove the contaminated water which had been used to clean out the swimming pool. During the transfer a few litres (50 mCi) were spilled and immediately recovered.

The general operation of the Reactor does not present any serious problems, except as regards the difficulties encountered with the safety rods since July. It will no doubt be possible to overcome these difficulties by heavy maintenance work planned for each shut-down between cycles in 1975.

The operation of the other sub-assemblies, particularly the cold and hot sources, continues to give satisfaction.

The detritiation installation has overcome the majority of its initial difficulties. Its present good operation permits heavy water from other reactors to be treated. There are, however, still some problems to be solved (particularly corrosion).

Reactor : Control Room.

REACTOR - MAJOR WORK IN 1974

SECONDARY COOLING CIRCUITS

Poor quality water from the Drac caused corrosion and blockages to these cooling circuits and this has led to the following additional investment :

- Entry in operation of semi-automatic filtration screens in 1974
- Creation of a separate cooling circuit in the Reactor. However, this circuit is not yet fully operating because of the experimental schedule.

HEAVY WATER

Following the failure of one of the two pumps in the DRG (leak-detecting) circuit, and while waiting for a spare, a stand-by pump of a different model was installed to avoid a complete and prolonged shut-down of the existing pump.

FUEL ELEMENTS

Eight fuel elements were cut in the hot cell during 1974 and sent for treatment to Marcoule.

Lead caskets for manoeuvring and transporting of whole elements are being prepared. The first whole fuel elements to be transferred to Marcoule are scheduled for the end of the first semester of 1975.

CONTROL AND SECURITY RODS

The control rod element was changed in January 1974. The level of negative radioactivity of the new control rod and security rods was effected in July 1974 with the assistance of a specialised service provided by Cadarache.

The unexpected releasing of the security rods started to appear in 1974.
The contamination of the swimming pool following the rupture of the starting source stopped normal repair work which would have consisted of replacing all or part of the top of the security rod. The control stripping down and re-assembly was made in situ and allowed the reactor to restart after a stoppage of 15 days.

DETRITIATION

- Volume of water treated (from 1/1 to 1/12/74) : 80.5 m^3
- Curies accumulated in 1974 : 128,600 Ci
- The activity in tritium of heavy water from the reactor is clearly maintained below 1.6 Ci/litre.

ELECTRICAL CONTROL

The control system for the neutron guide breach plugs was commissioned.
One start-up chamber (detector) change.
Work was carried out to improve on the interference problem on the cables supplying reactor instrumentation.
Temperature probes were installed in the bearings of the main cooling pumps.
The memory of the reactor computer was increased.

computing services

INTRODUCTION

1974 was a year in which no large new systems were installed, so that effort was largely devoted to improving the efficiency and reliability of existing systems.

Budget constraints have had a major impact on the activities of both groups. The members of Central Computer Group have had to spend much time ameliorating the consequences of saturation of system ressources and the environmental inconveniences of the computer room. The Informatique Group has been faced with difficulties in expanding the programming development facilities.

1 – INFORMATIQUE GROUP

The Informatique Group is responsible for designing, implementing and maintaining the control and data acquisition systems for automated instruments.

Whilst some new instrument systems have been introduced during the year, much of the work has gone into consolidating existing systems and improving the level of maintenance.

1.1 - CARINE systems

A new release of the system has been introduced, providing a better interface to CAMAC, and user program libraries on magnetic tape. CARINE 1 continues to support D2, D5, D8, D10, IN1, IN2; CARINE 2 has supported D1A, D1B, IN3 all year and added D9 in November. In addition it provides off-line facilities for IN4 and LI3. CARINE 3, which is used for testing and development, has been enhanced with a magnetic tape unit and card reader.

1.2 - NICOLE systems

NICOLE 1 supports D7, D11A, IN4, IN5, PN1. A new operating system has been introduced, together with automatic restart following power failures. Compared with 1973, better reliability has been achieved, although some hardware faults have given rise to concern.

NICOLE 2 is used principally for development and testing, but also provides a back-up for NICOLE 1, and was used to run D11A during May.

1.3 - PDP-11 systems

New systems introduced during the year have been D3 (implemented by the Rutherford Laboratory) and IN10. These, together with D6, PN2/PN3 (whose facilities have been improved) and SI4 use the ILL operating system RTS11. This has benefitted from several improvements, including the provision of a high-level language, BASIC.

A further PDP11/20 has arrived as part of the Cambridge X-ray instrument, LI7.

Systems currently under development are for D11B (using the very powerful operating system RSX-11D, in anticipation of also taking over D11A), and for IN9/IN11 using the operating system RT11. The latter system will use the computer released by the determination of the SI4 experiment.

Development work on D14 has been suspended in view of uncertainties about the detector system.

1.4 - Other Systems

Software support is provided for the PDP-8I on LI4 (the Siemens Diffractometer) and the NOVA 1220 on IN7.

1.5 - Maintenance

As a result of the reduced level of hardware support needed on CARINE and NICOLE the technicians were able to attend DEC courses on PDP 11 hardware and have now taken over responsibility for hardware maintenance of all PDP 11/40 systems.

A new procedure has been introduced for the provision of support for control systems outside normal working hours. This consists of regular inspections by trained reactor staff, with the aim of restarting after transient errors or, for more serious faults, identifying the appropriate specialist to call in.

DEC System 1070 : Central Computer

2 – CENTRAL COMPUTER GROUP

During the first half of the year, the usage of the DEC System 1070 Central Computer appeared to be levelling off, but there has been a signigicant upturn since the summer. This has placed a severe strain on the resources of the system, particularly the user terminals, disc drives and graph plotter.

The system is available for general use from 08.00 - 23.00 Monday - Friday and 09.00 - 18.00 on Saturday. The need to introduce 3-shift working has been avoided for the moment by permitting certain users with long jobs to take over the computer themselves (after appropriate instruction) outside the regular shifts.

The total number of jobs processed in the year was about 52000, 80% of this load coming from the experimental colleges (as compared with only 65% at the end of 1973). In part this reflects the very great increase in the rate at which date is being received from the automated experiments. The time needed to fill completely a 50 megabyte disc pack with data from CARINE and NICOLE decreased from one month at the beginning of the year to about one week at the end.

In addition to operating the PDP-10, members of Central Computer Group are engaged in the following activities:

- general improvements to the system software
- extension of the subroutine library
- development of techniques in numerical analysis
- assistance to users.

Visiting experimenters are now encouraged to take their results away on magnetic tapes, since tapes can now be generated in standard formats.

One important area in which it has not been possible to deploy sufficient effort is in providing programming assistance to scientists for data collection and reduction routines. It is felt that some priority must be given to this in 1975.

administration

The Administration group covers the Personnel and Finance services both of which are reported in detail below.

1974 has been characterised by one important feature in both of these areas. In the Personnel service negotiations are well underway with management and unions to establish a collective agreement which will replace the original 'Statuts de Personnel' (Decided by the Steering Committee in 1967).

On the Finance side the key issue, which will clearly be present for a long time, is inflation. Budget headings which looked not so bad at the beginning of the year had to be slimmed down, postponed or even indefinitely delayed as the year went on. Staff unit costs have also risen in a way which has influenced the authorised growth of staff itself and this lack of staff has made itself felt in every activity.

personnel

1 – STAFF COMPLEMENT

The complement of staff members at 31 December 1974 was 373 compared with 371 at 1st January 1974. The mean effective man-years service in 1974 was 389 compared with 351 man-years in 1973.

	Departures	Arrivals
Cadres supérieurs/Senior scientists	1	1
Physicists	19	14
Engineers	6	1
PhD Students	8	3
Technicians	4	9
Other categories	5	17

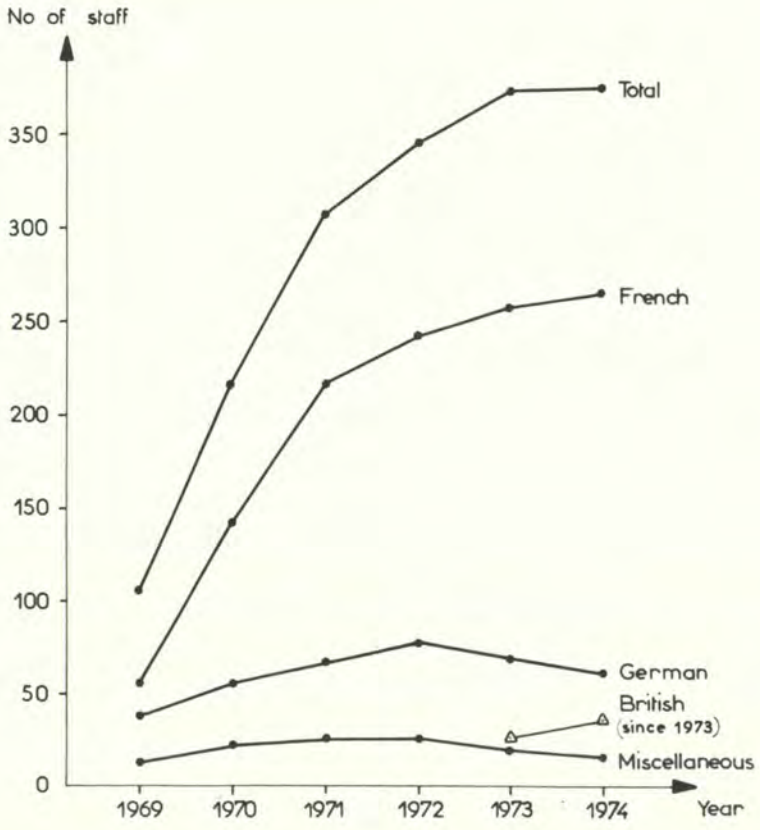
The first 5 staff scientist posts have been taken up. These are unlimited contracts and more will be available in succeeding years (scientists normally are given contracts of 2-5 years. Staff scientist posts are awarded to scientists of merit in order to guarantee a certain level of continuity of expertise).

The following table shows the breakdown of the staff by their professional category and their nationality (at 31st December 1974).

	French	German	British	Others	Total
Physicists	18	26	13	11	68
Administrators and Engineers	35	9	5	0	49
PhD students	15	7	2	2	26
Technicians	112	10	10	1	133
Other categories	83	8	4	2	97
Total	263	60	34	16	373

Vigorous efforts have been made to recruit in Britain and Germany in order to redress the balance of nationalities. A major advertising programme in the two countries is expected to show results in recruitment to be made early in 1975.

A special subcommittee of the Steering Committee has been set up to study the problem of attracting non-French personnel.



Development of Personnel by nationality 1969-1974

2 – INVITED SCIENTISTS

Not only does ILL invite scientists to perform experiments approved by the Scientific Council but it encourages them to come to give seminars and make general contributions to the scientific life of ILL. Many scientists spend sabbatical periods at ILL and there is a continuous exchange of expertise and staff between the national reactor laboratories.

On the occasion of the signature of the Intergovernmental Convention officialising the legal membership of the British partner, it was stressed that 'the Institut has become an European meeting point, whose importance can hardly be overestimated'.

The reception of these visitors is one of the most important duties of the Personnel office. For longer stay visitors legal formalities for residence in France must be established ; for medium term visitors (1-2 months) ILL can make available 25 appartments ; and for the great majority who stay only a few days there are hotel and travel arrangements to make.

In 1973 ILL received about 400 visitors. In 1974 this figure increased to some 800.

3 – PERSONNEL COSTS

1. - Salaries and charges

	1973	1974
Total salaries paid	17,746,000	22,913,000
Corresponding 'social' charges	6,740,000	8,101,000

The general increase in the CEA basic salary rates,which the ILL follows,due to cost of living has been 14.5% over the year.

(It should be noted that the salary budget is an integral part of the whole budget and is treated as such).

2. - Social security payments

One of the consequences of French company law is that a certain part of the budget is granted to the Comité d'Entreprise (Works Committee)

Among the many end uses for this money is the creation of a fund which makes up the difference between the real cost of medical expenses and the part repaid by the Social Security.

In 1974 this fund, administered by the Personnel Office, made 3,900 supplementary payments valued at 138,000 F.

In addition the superannuation fund IRRAPRI paid 33,000 F in 152 cases.

3. - Training

French law requires that companies of the size of ILL spend 1% of their salary budget on training. ILL Management attaches a great importance to the question of training. (Language training, for instance, is very important in a trinational institute). The money ILL actually spends for training purposes is well in excess of the amount prescribed by the law.
All members of staff are encouraged to take language courses and in 1974,123 did. In addition courses were arranged for the wives of new members of staff.

A wide range of other courses was taken by 54 people.

4. - Travel costs

A total of 450 'man-visits' was made in 1974 costing some 400,000 F.

5. - Housing grants

Employers in France are required to make available a sum of 0.9% of the salary bill to help employees find credit for housing.
In 1974,11 such loans were made by the ILL with a total value of 110,000 F.

4 — NEGOCIATIONS WITH UNIONS AND OTHER ELECTED BODIES

ILL, like all French companies, is subject to French company law. This implies the presence of the elected 'Comité d'Entreprise' and 'Délégué de Personnel', as well as French unions (at the ILL 'la Confédération Générale du Travail' and 'la Confédération Française Démocratique de Travail') and ILL's own union SILLG. In 1967 the Steering Committee, in collaboration with ILL Management produced a working document known as the 'Statut de Personnel' (personnel rules). The union asked the Steering Committee for the right to negociate a new collective agreement. This was agreed and negotiations have begun and will continue in 1975.

During the two meetings of the Steering Committee in 1974, 4 elected members of the 'Comité d'Entreprise' were present as observers representing the personnel of ILL.

5 — MEDICAL PROBLEMS

Originally the medical supervision of ILL staff was undertaken by the CEA in Grenoble (CENG) but 1974 saw the creation of independent facilities at ILL. The small infirmary has been altered allowing for examination and analytical facilities. A second doctor has been engaged and now all ILL staff who work in the controlled area as well as visitors who stay longer than 6 months can be examined at ILL. In addition chest X-ray facilities are available twice a year.

6 – SCHOOLING

The experimental primary school, Houille Blanche, is now in its second year and good progress is reported. The school is a French one and the system and method of education is also French with major concessions for the English and German children.
Of 25 children in each class there are usually 10 foreigners and 15 French.
On their arrival, children get special teaching in the French language and for those who are about to depart they get special tuition to allow them to readapt quickly. Normally the British and German children receive one hour of teaching in their own language while the French children learn English or German.

A memorable occasion was the school open day in May when the children presented an entertainment in the 3 languages to their parents and other visitors.

At the secondary level the senior class of last year's primary school and a few others are now installed at the 'Lycée des Eaux Claires' where the experimental method is similar to that at the primary school. An English and German teacher have been engaged to ensure that the students do not lose contact with their own culture.

At the moment the considerable excess costs (teacher's salaries, materials etc..) incurred by the two schools are met entirely by ILL, despite protracted negotiations with the British and German governments for funds.

finance

1 – BUDGET 1974

1. The Budget approved for the report period provided for total authorisations for payment of 65.3 Mio F. (after deduction of ILL's own income). The additional sum of 2,6 Mio F. carried forward from the 1973 Budget provided the Institut with total funds of 67.9 Mio F. for the year 1974. According to the provisional accounts for 1974 the actual expenditure was as follows :

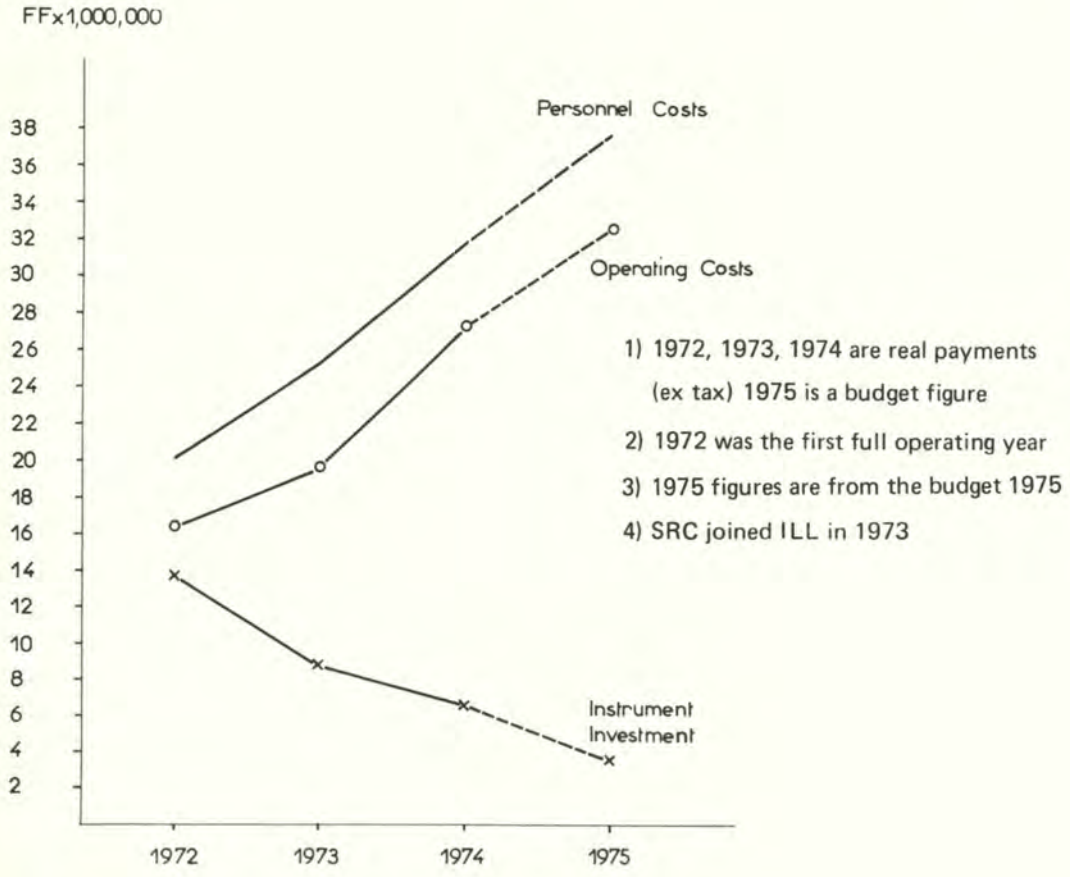
(a) Operation	F 1974 (x 1.000)	F 1973 (x 1.000)
Consumable materials and small equipment	4.400	4.292,
Fuel elements	9.630,	3.511,
Staff Costs	31.728,	25.274,
Long-term service contracts	6.300	5.805,
Other work, supplies and services from third parties	4.107	3.499,
Transport, removal and travel expenses	900,	641,
Miscellaneous administrative costs	2.000,	1.789,
TOTAL Operation	59.065,	44.815,
(b) Investments		
Buildings	790,	529,
Equipment (except experimental equipment)	1.227	782,
Experimental equipment	5.058	2.299
Other investments	1.750	2.702
TOTAL Investments	8.825	6.314
TOTAL Budget	67.890	51.129

Apart from a balance of 8.720,0 F., the funds provided in the 1974 Budget were completely used up. The large price increases in 1974 have led to a considerable reduction in real terms in investment expenditure. It was only possible to remain within the limits of the 1974 Budget by delaying the expansion programme in the field of experimental instruments.

The adaptation of the accounting system to the modified organisational structure was completed during the report period. The entire budget control system is now computerised, permitting up-to-date information to be provided on expenditure trends in the individual fields. Expenditure for 1974 is shown below under the main organisational fields in the ILL.

	F (x 1.000) 1974	F (x 1.000) 1973
Experimental sciences and theoretical physics	15.000	12.879
Operation of the experimental instruments	3.500	140
Computing services	5.120	4.867
Scientific support	8.000	7.445
Reactor operation	23.000	14.086
Technical support	5.700	5.407
Administration	7.571	6.302
	67.891	51.129

2 FINANCIAL DEVELOPMENT 1972 - 1975



3. - PURCHASING

As regards purchasing, efforts were made during the report period to,place more orders with British industry, but these efforts met with only limited success. The budgetary problems mentioned above have led to a reduction in purchasing activity, and it was also more than ever necessary to accept the most economic bid.

More positive results in this direction are anticipated with the more intensive assistance of the British Associate.

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ILL PUBLICATIONS 1974

(References arranged by Code Number)

Example of Code Number : 74 Y 137

74	stands for the year the paper was published
Y	stands for the first letter of the first author's name
137	is the serial number of registration.

The letters T and S behind a code number indicate that this report is an INTERNAL TECHNICAL and SCIENTIFIC REPORT respectively.

These reports are kept in the ILL Library.

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ALPHABETICAL LIST OF PUBLICATIONS

This list is intended as an index to the previous list. It gives all the publications in which a person has cooperated, but need not have been the principle author.

CONFERENCES AT ILL IN 1974

– Workshop on Magnetic Moment Distributions (organized by H. Fuess and S.W. Lovesey)	(January 1974)
– Discussion Meeting on Al-alloys (organized by G. Kostorz)	(March 1974)
– Workshop on One Dimensional Electronic and Magnetic Systems (organized by J. Ranninger and S.W. Lovesey)	(March 1974)
– Recherche Concertée Programmée «Spectrométrie Neutronique» (organized by C.N.R.S.)	(June 1974)
– Chemistry Information Meeting (organized by J. Higgins)	(October 1974)
– Workshop on Crystalline Electric Fields in Rare Earth Compounds (Organized by W. Drexel)	(October 1974)
– Fission Information Meeting and Workshop (organized by M. Asghar)	(October 1974)

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The experimental work of which was carried out at ILL.

74G171 Claude GUET, Thèse de 3ème Cycle. (Septembre 1974). Emission de Deux Photons lors de la Capture Radiative Neutron-Proton.

74X172 Nicolas XIROMERITIS, Thèse de 3ème Cycle (Juil. 74) Utilisation d'un Aimant de Stern–Gerlach pour la Mesure de la Polarisation d'un Faisceau de Neutrons.

74J173 Christian JEANDEY, Thèse de Doctorat d'Etat (Oct.74) Utilisation de l'Effet Mössbauer en Ligne pour une Contribution à l'Etude des Défauts de Recul dans les Solides.

74G178 Jean-Paul GAUTHERON, Thèse de Docteur-Ingénieur (Décembre 1974). Contribution à l'Etude des Précurseurs de Neutrons Retardés de Fission.

EXPERIMENTS PERFORMED AT ILL 1974

The following is simply a list of the experiments performed at ILL in 1974.

Please refer to the Annex to the Annual Report for a detailed study of the results. (At the time of publication, January 1975, about 2/3 of the experiments carried out in 1974 were reported).

** Experiment carried out in 1973, the report of which has been submitted in 1974.

* Experiment commenced or carried out during 1974 without submitted report.

01.002 Bragg diffraction interferometry with thermal neutrons. — SI 12

U. Bonse, W. Bauspiess (Dortmund) ;
W. Treimer, M. Schindler, H. Rauch (Wien) ;

Phase mixing in the critical region of the ferro electric phase transition in KD_2PO_4 — H_{24}

C. Zeyen, H. Meister (Ispra - Italie)

Polarizing mirrors — SI 3

B. Hamelin (ILL)

COLLEGE 3

Beam Work

03 03 003 New experimental limit on T-invariance in polarized neutron β-decay. — H 14

R.I. Steinberg, P. Liaud, B. Vignon
W. Hughes (ISN Grenoble and Yale) ;

03 03 004 Gamma ray asymmetry in Radiative n - p capture of polarized neutrons — SI_1

E. Jeenicke, P. Liaud, B. Vignon, R. Wilson
(ISN Grenoble and Harvard)

03 02 005 (n_{th} , α) - and (n_{th} , $\gamma\alpha$) - reactions on medium and heavy nuclei.

A. Emsallem, R. Chery (Lyon) ; M. Asghar (ILL) ;

03 03 006 Measurement of the neutron electric dipole moment — SI_4

J.M. Pendlebury (Sussex) ; N.F. Ramsey (Harvard)
P. Perrin (CEN-G) ; W.B. Dress, P.D. Miller (ILL/ORNL) ;

03 03 009 Observation of two Photon in n-p capture. — H_{18}

C. Guet (ISN) ; W. Dress, P.D. Miller (ILL/ORNL) ;
P. Perrin (CEN-G) ;

03 01 005 Study of β -nd- γ phenomenon i.e. where the delayed neutron leaves the final nucleus in one or more than one excited states. — PN 1

G.I. Crawford, S.J. Hall, J.D. Kellie (Kelvin Laboratory, Glasgow)
J.Crançon, C. Ristori, J.P. Bocquet (Cen-G) ;
M. Asghar, J.P. Gautheron, G. Bailleul, J. Greif,
H. Schrader, G. Siegert (ILL) ;

03 01 006 Delayed neutron time-of-flight test run. — PN 1

G.I. Crawford, S.J. Hall, J.D. Kellie, (Kelvin Laboratory) ;
J. Crançon, J.P. Bocquet, C. Ristori, (CEN-G) ;
M. Asghar, J.P. Gautheron, G. Bailleul, J. Greif,
H. Schrader, G. Siegert (ILL) ;

03 01 013 Ionisation chamber for isobaric separation. — PN 1

K. Sistemich (Jülich),
P. Armbruster, (Darmstadt)
C. Chauvin, J.P. Bocquet, (CEN-G) ;
Y. Glaize, M. Asghar, G. Bailleul, J.P. Gautheron,
J. Greif, H. Schrader, G. Siegert (ILL) ;

03 01 014 Nuclear charge distribution and Qβ values of fission products measured by very high mass resolution of LOHENGRIN. — PN 1

H. Wollnik, G. Fiedler (Giessen) ;
J.P. Bocquet (CEN-G) ;
G. Siegert, J. Greif, M. Asghar, G. Bailleul,
J.P. Gautheron, H. Schrader (ILL) ;

03 01 016 Study of fission products γ spectra. — PN 1

J. Blachot, J.P. Bocquet, E. Monnand, F. Schussler,
C. Chauvin (CEN-G) ;
R. Stippler (Braunschweig) ;
G. Bailleul, H. Schrader, M. Asghar, J.P. Gautheron,
J. Greif, G. Siegert (ILL) ;

03 01 018 Search for and measurement of new delayed neutron activities. — PN 1

G.I. Crawford (Kelvin Lab., Glasgow) ;
C. Ristori, J. Crançon, J.P. Bocquet (CEN-G) ;
M. Asghar, J.P. Gautheron, G. Bailleul, J. Greif,
H. Schrader, G. Siegert (ILL) ;

03 01 022 Test and application of special glass detectors. — PN 1

G. Fiedler, H. Wollnik, (Giessen) ;
J.P. Bocquet (CEN-G)
G. Siegert, J. Greif, M. Asghar, G. Bailleul,
J.P. Gautheron, H. Schrader (ILL) ;

03 01 023 Alignement of a fast transport system for nonvolatile fission fragments using a gas jet. — PN 1

J.P. Bocquet, F. Schussler, (CEN-G) ;
B. Pfeiffer, H. Wollnik (Giessen) ;
M. Asghar, J.P. Gautheron, J. Greif, H. Schrader,
G. Siegert (ILL) ;

03 01 024 Separation of isobaric elements by the energy loss dispersion in carbon absorber foils and time-of-flight. — PN 1

H.G. Clerc, K.H. Schmidt, W. Lang, K.E. Pferdekämper, R. Jungmann (TH Darmstadt) ;
J.P. Bocquet (CEN-G) ;
H. Wohlfarth, H. Schrader, M. Asghar, G. Bailleul,
J.P. Gautheron, J. GReif, G. Siegert (ILL) ;

03 01 025 Nuclear charge distribution of mass separated fission products. — PN 1

H. Wollnik, G. Fiedler (Giessen) ;
J.P. Bocquet (CEN-G) ;
G. Siegert , J. Greif, M. Asghar, G. Bailleul, R. Decker,
J.P. Gautheron, H. Schrader (ILL) ;

03 02 003 Excited states in ^{133}Ba. — PN 3, PN 4

A. Gizon, J.R. Gizon (ISN) ;
J.A. Pinston, R. Roussille (ILL) ;
D. Heck (Karlsruhe) ; H. Börner (Jülich) ;

03 02 004 — Excited states in ^{80}Br. — PN 3 PN 4

Do Huu Phuoc (IPN, Lyon) ; D Heck (Karlsruhe), H. Börner (Jülich) ; J.A. Pinston, R. Roussille (ILL) ;

03 02 005 — Study of the γ-ray spectrum following thermal neutron capture in ^{238}U. — PN 3 PN 4

H. Börner, H.R. Koch (KFA Jülich) ;

Band structure of the excited states in ^{184}W. — PN 3 PN 4

D. Heck (Karlsruhe) ; H. Börner (Jülich) ; H.R. Koch, J.A. Pinston, R. Roussille (ILL) ;

Determination of the level structure of ^{100}Tc following neutron capture in ^{99}Tc. — PN 2 PN 3 PN 4

D. Heck (Karlsruhe) ; H. Börner, H. Koch (Jülich) ; J.A. Pinston, F. Braumandl, P. Jeuch, W. Mampe, R. Roussille, K. Schreckenbach (ILL) ;

Excited states in ^{147}Nd. — PN 3 PN 4

D. Heck (Karlsruhe) ; H. Börner, H. Koch (Jülich) ; Do Huu Phuoc (IPN, Lyon) ; R. Roussille, J.A. Pinston (ILL) ;

Excited states in ^{149}Nd. — PN 3 PN 4

D. Heck (Karlsruhe) ; H. Börner (Jülich) ; Do Huu Phuoc (IPN, Lyon) ; J.A. Pinston, R. Roussille (ILL) ;

171 Yb (n, é) 172 Yb. — PN 2

W. Gelletly, (Manchester) ; J. Larysz, F. Braumandl, P. Jeuch, W. Mampe (ILL) ;

COLLEGE 4

04 01 001 — Phonon spectrum in magnesium fluoride — IN 1

R. Almairac, D. Tocchetti (ILL) C. Benoit (Montpellier) — IN 2

(**) 04 01 007 — Phonons in Se — IN 1

W.D. Teuchert, R. Geick, G. Landwehr (Würzburg) H. Wendel, W. Weber (Stuttgart) — IN 3

04 01 009 — Lattice dynamics of Thallium — IN 3

W. Reichardt, B. Renker (Karlsruhe) V. Wagner (ILL)

04 01 011 — Surface phonons — IN 4

K.H. Rieder (Stuttgart), W. Drexel (ILL)

04 01 012 — Phonons and librons in solid He — IN 5

H. Stiller, M. Arsic, H. Spitzer, H. Meyer, R.E. Lechner, F. Volino, R. Scherm (ILL)

04 01 013 — Phonons in deuterated urea. — IN 2

J. Lefevre, M. More (Lille), R. Currat (ILL)

** 04 01 015 — Phonon dispersion curves in InP and InAs — IN 2

G.F. Alfrey, P.H. Borcherds, D.H. Saunderson (Birmingham), A.D.B. Woods (ILL)

04 01 016 — Phase transition in $(CD_3)_4NMnCl_3$ — IN 2

M.T. Hutchings (AERE Harwell) G.S. Pawley (Edinburgh), W.G. Stirling (ILL)

04 01 020 — Zero sound and transition to first sound in RbI — IN 7

J. Daubert, A. Loidl (Frankfurt/Main) W. Drexel, A. Murani (ILL)

04 01 022 — Dispersion of optical phonons in sapphire (α-Al_2O_3) — IN 1

H. Bialas, W. Kappus, H.J. Stolz, O. Weis (Heidelberg)

04 01 023 — Phonon dispersion in NiO — IN 1

W. Reichardt (Karlsruhe) V. Wagner, W. Kress (ILL)

04 01 025 — Phonon dispersion in A_gB_r of the transverse mode Eigenvectors at L. — IN_2

B. Dorner (ILL)

W. Von der Osten (Darmstadt)

* 04 02 003 — Pressure dependence of phonon in RbI — IN 2

Quittner, Blaschko, Ernst (Seibersdorf)

04 02 007 — Inelastic scattering from the Kohn peierls anomaly as a function of temperature in the I - d conductor $K_2Pt(CN)_4Br_{0.30}\cdot xH_2O$ — IN 2

Renker (Karlsruhe), Comes (Orsay), Currat (ILL)

04 02 013 — Investigation of the temperature dependence of the phonon density of the states of Nb_3Sn — IN 4

N. Nücker, E. Schneider, W. Reichardt, P. Schweiss (Karlsruhe)

04 03 001 — Eigen vector determination of two interacting modes in quartz studied by inelastic neutron scattering. — IN 2

H. Grimm (Jülich), B. Dorner (ILL) F. Frey, W. Prandl (München)

* 04 02 035/036 — K_2CuF_4 — IN 3

F. Moussa (Saclay)

04 03 001 — SiO_2 — IN 2

H. Grimm (Jülich), B. Dorner (ILL)

04 03 004 — Soft modes and critical scattering in [111] stressed $SrTiO_3$ — IN 2

K.A. Müller, W. Berlinger (Suisse - Ruschlikon) F. Denoyer (Orsay), R. Currat (ILL)

04 03 009 — Acoustic phonon anomaly due to the Jahn Teller phase transition in $TbVO_4$ — IN 3

S.H. Smith (Oxford), M.T. Hutchings (Harwell) S.R. Smith (Essex), R. Scherm (ILL)

04 03 011 — Soft modes and correlations in $NaNbO_3$ — IN 2

F. Denoyer, R. Comès, M. Lambert (Orsay) R. Currat (ILL)

04 03 012 — Phonon dispersion in $LiNbO_3$ — IN 1

D.H. Saunderson (AERE Harwell) G.E. Peckham, M.R. Chowdhury (Heriot-Watt) D. Tocchetti (ILL)

* 04 03 014 — RbI — D 7

Quittner (Seibersdorf)

04 04 001 — Magnetic excitations in $KCoF_3$ — IN 1

G. Parisot, D. Tocchetti (ILL) M.T. Hutchings (AERE Harwell)

04 04 002 — Inelastic neutron investigation of the anisotropy of the spin wave Linewidthin in the one - dimensional — IN 2

B. Dorner, M. Steiner, J. Villain (ILL)

* 04 04 005 — Spin-wave spectrum in Ni-V alloy — IN 1

F. Gautier (Strasbourg) D. Tocchetti (ILL), B. Hennion (Saclay)

04 04 007 — Excitation in $FeCl_2$ and magnetoelastic interactions under high pressure — IN 2

C. Vettier W.B. Yelon (ILL)

04 04 010 — MnF_2/ZnF_2 - KM_nF_3/KN_iF_3 — IN 2

R.A. Cowley, G.J. Coombs (Edinburg) G. Parisot (ILL)

04 04 013 — Spin wave dispersion of nickel sulphide — IN 1

M.T. Hutchings and R.D. Lowde (Harwell) G. Parisot, D. Tocchetti (ILL)

04 04 015 — Spin wave damping and renormalisation in $RbMnF_3$ — IN 3

C.G. Windsor, D.H. Saunderson (AERE Harwell) E. Schedler (ILL)

04 04 017 — Spin waves in $Fe_{51}Rh_{49}$ — IN 1

B. Hennion (Saclay) D. Tocchetti, A. Castets (ILL)

04 04 023 — Inelastic spin flip scattering of cold neutrons in vanadium oxides — IN 10

A. Heidemann (ILL)

04 04 024 — Hyperfine splitting of protons in magnetic materials — IN 10

A. Heidemann (ILL)

Richter - Töpler

04 04 029	Spin waves in Pd_3Fe A.J. Smith (Edinburgh) WG. Stirling (ILL)	IN 1
04 04 034	Optical magnons in Mn_{2-x} Cr_x Sb (x 0.125) S. Funahashi (Japan) W.G. Stirling (ILL)	IN 1
04 04 037	Dynamics of the two dimensional Ising system K_2 C_0 F_4 M. Steiner, M.T. Hutchings (ILL) K. Hirakawa (Tokyo)	IN 2
• 04 04 038	Invar ; Ni-Mo, Ni-Ru, Ni-Fe B. Hennion (Saclay) D. Tocchetti (ILL)	IN 2
•• 04 05 001	Study of rotational diffusion in ammonium halides R.E. Lechner, F. Volino, A.J. Dianoux (ILL) H. Hervet (College de France)	IN 4 IN 5
• 04 05 002	SeF_6 A.J. Dianoux (ILL)	IN 5
04 05 003	Rotational motion in the plastic phase of quinuclidine C. Brot,(Nice), B. Lassier, Govers (Ontario) R. Lechner, F. Volino (ILL)	IN 5
• 04 05 004	$C_{10}H_{16}$ R.E. Lechner (ILL)	IN 5
04 05 007	Reorientational dynamics of succinonitrile in the plastic phase J.P. Amoureux, M. Bée, R. Fouret (Lille) R.E. Lechner (ILL)	IN 5
04 05 010	Study of rotational diffusion in plastic crystals using the backscattering technique. R.E. Lechner, A. Heidemann (ILL)	IN10
04 05 011	Rotational motions in NH_4Cl J. Töpler, D. Richter, B. Alefeld (Jülich) A. Heidemann (ILL)	IN10
04 05 012	Quasi-elastic scattering on β-AgJ Funke (Göttigen), Kalus (Tübingen) Heidemann (ILL)	
04 05 014	Vibrations and reorientations in trimethylammonium-chloride J.C. Lassegues (Bordeaux), M. Schlaak (Darmstadt) A. Heidemann, R.E. Lechner (ILL)	IN 4 IN 5 IN10

COLLEGE 5

•• 05 01 001	Structure determination of C_2H_5Li A. Tippe (München) ; Dietrich (Berlin) Lehmann (ILL)	D 10
•• 05 01 003 see 05 02 010	Hydrogen bonds in manganese acetate A. Filhol, M. Thomas (ILL) Tran Qui Duc (CNRS-G), Paulette Burlet Paul Burlet (CEN-G)	D 8
•• 05 01 005	Crystal structure of 4 Pb0 $PbSO_4$ H. Bartl (Frankfurt) ; S.A. Mason (ILL)	D 10
05 01 010	Crystal structure and hydrogen positions in Ba $NH_4P_3O_9$ H_2O A. Durif, R. Masse (CNRS-Grenoble) H. Fuess (ILL)	D 10
05 01 016	Hydrargillit Al $(OH)_3$ F. Zigan, W. Joswig (Frankfurt) S. Mason (ILL)	D 10
05 01 020	Intramolecular hydrogen bonding in 6 hydroxyfulvene- aldehyde H. Fuess (ILL) ; H.J. Lindner (Darmstadt) ;	D 10
05 01 025	Anomalous scattering of neutrons by rare earths, using ferroelectric T_2 (M_oO_4) 3 crystals B. Morlon (Dijon) ; C. Berthet (ILL)	D 2
•• 05 01 028	Electron density in Cr $(CO)_6$ B. Rees (Strasbourg) ; W. Yelon (ILL)	D 10
05 01 031 05 01 052	Refinement of the crystal structure of stilbite Na_2 Ca_4 $(Al_{10}Si_{26}O_{72})$ 34 H_2O_2 by neutron diffraction. D.W. Jones, R. Wardle (Bradford) M.S. Lehmann (ILL)	D 8
•• 05 01 035	Diffuse scattering in $MgO_3Al_2O_3$ G. Patrat, F. de Bergevin, M. Brunel (CNRS-G) W. Yelon (ILL)	D 10
05 01 036	Structure of bis (triphenylphosphine) 1 - ethynylcyclohexanol - platinum B. Klar (ILL) ; S. Rasmussen (Aarhus)	D 6
05 01 037	Strong hydrogen bonding study by neutron diffraction J.P. Bideau (Uni. Bordeaux) ; A. Filhol (ILL)	D 8
•• 05 01 038	Crystal structure of scolecite H. Bartl (Frankfurt) ; W. Yelon (ILL)	D 10
•• 05 01 039	Hydrogen bonding in $CaHPO_4$ (monetite) G. Ferraris, M. Catti (Turin) A. Filhol (ILL)	
05 01 040	NH_4 NH_3 CH_2 COOH SO_4 S. Vilminot, E. Philippot (Montpellier) M. Lehmann (ILL)	D 10
•• 05 01 041	The structure of $FeCl_2$ at high pressures C. Vettier, W. Yelon (ILL)	D 10
05 01 042	Structure of diclioroordurene at very low temperatures. Messager - Cailleau (Rennes) W. Yelon (ILL)	D 10
05 01 045	Investigation of the domain structure of plagioclase feldspars (Labradorite) W. Joswig, M. Korekawa (Frankfurt) S. Wilson (ILL)	D 16
• 05 01 046	Structure determination of samarium acetate and Gd acetate by anomalous dispersion T. Duc (CNRS-G) H. Bartunik, H. Fuess (ILL)	D 8
05 01 047	Structure determination of Cd-Histidine dihydrate by the anomalous dispersion technique H. Bartunik, H. Fuess (ILL), T. Duc (CNRS-G)	D 8
•• 05 01 048	Crystal and molecular structure of mercury (II) acetamide. B. Kamenar (Zagreb), H. Fuess, S.A. Mason (ILL)	D 8
05 01 051	Growth of graphite in carbon steel G.E. Bacon, N. Cowlam (Sheffield) D. Hohlwein (ILL)	D 2
05 01 052	See 05 01 031	D 8 D 10
05 01 053	The structure of α- AgI and of the hybrides of early Lanthanide elements B.E.F. Fender, A.F. Wright, C.G. Tilcomb, A. K. Cheetham (Oxford)	D 2
• 05 01 054/055	Df_2 B.E.F. Fender (Oxford), Waddington (Durham)	D 2 D 7
05 01 056	Location of the hydridic hydrogen atom and accurate determination of bond lengths in nonacarbonyl - μ(terbuthylacetylene) - triangulo- triruthenium C_{15} H_{10} O_9 RU_3 M. Catti, G. Gervasio (Torino); S.A. Mason (ILL)	D 8
• 05 01 059	Structure analysis of KCN in the low temperature phase Dultz (Regensburg) ; Knorr (Frankfurt) ; W. Yelon (ILL)	D 10
05 01 060	Structural transitions in ferroelectric $Na_xK_{1-x}NbO_3$ M. Ahtee (Helsinki) ; A.W. Hewat (ILL) ;	D 1A
05 01 061	Phase transitions in $PrAlO_3$ R.T. Harley (Clarendon, Oxford) ; A.W. Hewat (ILL)	D 1A

05 01 062	Profile refinement of the structure of hydrogen bonded materials $NH_4H_2PO_4$, $NH_4H_2AsO_4$ and KH_2PO_4 phase transitions A.W. Hewat (ILL)	D 1A
05 01 063	Iron order and magnetic studies by neutron diffraction of $Fe_{1.11}Te$. J.P. Senateur, R. Madar (Vitry/Seine) D. Fruchart R. Fruchart (CNRS) ; P. Convert, P. Wolfers (ILL)	D 1B D 10
05 01 064	Powder diffraction patterns of the β-sialons G.E. Bacon, J.S. Plant, (Sheffield) ; K. Jack (Newcastle)	D 1A D 1B
05 01 065	Refinement of the structure of UCr_2O_6 by neutron diffraction with a single crystal. Gondrand (CNRS-G) ; P. Burlet (ILL)	D 10
05 01 066	The Verwey transition in Fe_3O_4 G.L. Paul (Australie - Kensington) W. Yelon (ILL)	D 10
05 01 067	The structure of Li $(ND_3)4$ P. Chieux (ILL), F. Debaecker (Lille)	D 1B
05 01 068	Study of manganese acetate tedrahydrate P. Burlet (ILL)	D 1A D 2
05 01 069/074	$KHCO_3$ and $KDCO_3$ A.K. Cheetham (Oxford) ; H. Fuess (ILL)	D 1A
05 01 071	Localisation of fluorine atoms in the solid solution $NaYF_4$-YF_3	D 10
05 01 084	Structural studies on layered dichalcogenides and intercalated compounds Riekel (ILL) ; Fender (Oxford) ; Schällhorn (Munich) ;	D 1A
05 02 003	Magnetic structure of CuFe G_eS4 Wintenberger ; P. Burlet (CEN-G)	D 2
05 02 005	Neutron diffraction investigations on PdF_3 D. Paus - B. Müller - R. Hoppe (Giessen)	D 1A
05 02 010	Study of manganese acetate tetrahydrate P. Burlet (ILL) ;	D 1A
05 02 015	TbP04 Schäfer (Bonn) ; C. Berthet (ILL)	D 2
05 02 023	YCO_2 - Magnetic problems Schweizer, Tasset (ILL)	D 5
05 02 024	$PrCO_2$ - Magnetic problems Schweizer, Tasset (ILL)	D 5
05 02 025	$HoCo_2$ - Magnetic problems Schweizer, Tasset (ILL) ; Gignoux, Lemaire (CNRS - G)	D 5
05 02 026	Forms factor of the rare earth in RAl_2 compounds Schweizer, Radhakrishna (ILL)	D 5
05 02 029	Polarized neutron study of Yttrium iron garnet (YIG) at 4,2° K M. Bonnet, A. Delapalme (DRF/DN CEN-G), H. Fuess (ILL)	D 1A D 5
05 02 030	Study of the magnetic structure of Mn_2Ge 04 at 4,2° K H. Vincent, F. Bertaut (CNRS - G)	D 1A
05 02 031	One dimensional correlations in TMNC $((CH_3)_4NNiCl_3)$ Steiner (ILL) ; Kurtz (Tübingen)	D 2
05 02 033	Spin density of the free radical N-0 Schweizer (ILL)	D 5
05 02 035	Vector magnetisation density P.J. Brown, J.B. Forsyth (ILL)	D 5
05 02 036	A neutron diffraction determination of nuclear structure of Bi $Fe0_3$ and the Fe (III) magnetic moment A.J. Jacobson, B.E.F. Fender (Oxford) ;	D 5
05 02 044	Investigation of ferro, ferri and antiferromagnetic domains through neutron topographic and related methods M. Schlenker (CNRS-G), J. Baruchel	D 2
05 02 050	Antiferromagnetic $La_2Fe_2S_5$ R. Plumier, M. Sougi (Saclay)	D 1B
05 02 051	Magnetic structure of uranium and neptunium oxides, carbides and carbonitrides (powders) De Novion (Fontenay-aux-Roses) ; P. Burlet (CEN-G), C. Berthet (ILL)	D 1A D 2
05 02 052	Magnetic structure of $CsMnFeF_6$ Temperature dependence of diffuse scattering W. Kurtz, R. Geller, F. Binder (Tübingen) ; P. Convert, H. Dachs, M. Steiner (ILL)	D 1B
05 02 054	First order transition in manganese monoxide D. Bloch, R. Maury, C. Vettier (CNRS-G) W. Yelon (ILL)	D 1A
05 02 055	Powder measurements on FeGe (cubic) small angle scattering on FeGe (cubic) and MnSi. C. Wilkinson, F. Sinclair (London) J.B. Forsyth (ILL)	D 2
05 02 056	Paramagnetic scattering form iron with polarization analysis C.G. Windsor (AERE Harwell), G. Squires (Cambridge) A.M. Vallera (Harwell)	D 5
05 02 057	PaO_2 structure, atomic and magnetic F.A. Wedgewood (AERE Harwell)	D 2
05 02 058	Cr_2B - magnetic structure P.J. Brown	D 1A
05 02 060	Magnetochemie von NbO_2 Meyer (Giessen), H. Fuess (ILL)	D 1B
05 02 061	Solid solution $NiTiO_3$ - α Fe_2O_3 Marnier (Nancy) ; P. Convert (ILL)	D 1B
05 02 062	Solid solutions $CoTiO_4$ - $CoFe_2O_4$, $Co_{2-t}Zn_tTiO_4$ Hubsch (Nancy) ; P. Convert (ILL)	D 1B
05 02 065	See 05 02 081	D 1A
05 02 071	Neutron topography Schlenker (CNRS-G), Wilson (ILL) ;	D 16
05 02 073	The determination of the magnetic structure of $DyMn_2O_5$ Wilkinson, Sinclair (London) Forsyth (ILL)	D 2
05 02 074	Feasibility study of the application of profile analysis for a hydrate (Ni Se 0_4 $6D_20$) A. Kallel (Tunis) ; H. Fuess (ILL)	D 1A
05 02 075	Magnetic structure of $NpAs_2$ P. Salmon (CEN-G) ; P. Wolfers (ILL) ;	D 1B
05 02 076	The compound $CrUS_3$ and the study of the system MS - $(US_2)_n$ 1. part : Compound $CrUS_3$ P. Wolfers, M. Bacmann (CNRS-G), H. Noel (Rennes) P. Convert (ILL)	D 1B
05 02 078	Magnetic structure and refinement at 4,2°K of UCr_2O_6 Gondrand, Collomb (CNRS-G)	D 2
05 02 081/065	Magnetic and structural phase transition in $(N\ H4)_2\ MnF_5$ M. Steiner (ILL)	D 1A
05 03 001	TiC powder S.E. Rasmussen (Aarhus), A. Norlund Christensen H. Fuess (ILL)	D 1A D 10
05 03 002	Electron density in Ti_4O_7 M. Marezio, C. Schlenker, L. Lakkis (CNRS-G) W. Yelon (ILL)	D 10
05 03 003	Study of the molecular and crystalline structure of some organic semi-conductors as a function of temperature and the charge transfer complexes of TNCQ. A. Filhol, P. Combelas (ILL) ;	D 10

05 03 004	Electron density study of ethyl lithium A. Tippe, C. Scheringer (Neuherberg) M.S. Lehmann (ILL)	D 10
05 04 002	See 05 02 035	D 5
05 04 007	Spin density in TCNQ salts. P. Combelas, A. Filhol, J. Schweizer (ILL) ;	D 5
• 05 04 008	Separation of covalent and orbital effects in neutron scattering from FeF_2 J. Brown (ILL) ;	D 5
05 04 011	Distribution of magnetic moment in a Cerium compound Radhakrishna, F. Livet (ILL) J. Pierre, Morin (CNRS-G)	D 1 A D 5
• 05 05 001	Cyclodextrin Saenger (Göttingen) ; Klar (ILL) ;	D 6
05 05 002	Hydrogen-bonds and thermal-motion in pyridoxine hydrochloride G.E. Bacon, J.S. Plant (Sheffield)	D 8
05 05 007	Motion of great amplitude in P. Terphenyl J.L. Baudour, H. Cailleau (Rennes) W. Yelon (ILL)	D 5
• 05 05 010	Urea S. Mason, M.S. Lehmann (ILL) ;	D 1 A

COLLEGE 6

• 06 01 001/ 011	N_2 : dynamicsof molecular Liquids R.N. Sinclair (AERE Harwell) J. Clarke, J.C. Dore (Canterbury), P. Chieux (ILL) ;	IN 1
• 06 01 003	Catalysis Renouprez (Villeurbanne)	IN 1
06 01 005	Neutron scattering in liquid crystals A.J. Dianoux, R. Lechner, F. Volino (ILL) ; H. Hervet (orsay) ;	IN 5/ IN 10
• 06 01 006	WF_6 A.J. Dianoux (ILL) ;	IN 4
• 06 01 007	Graphite C. Marti (ILL) ;	D 1 B D 2
06 01 008	Liquid dynamics of CH_2Cl_2 P.N. Brier, A. Perry (Manchester) C.J. Wright (Harwell) ;	IN 5
06 01 009	Molecular motions in liquid crystals A.J. Leadbetter, F.P. Temme (Bristol) ; A. Heidemann (ILL) ;	IN 5 IN 10
06 01 012	Quasi elastic scattering of neutrons in glycerol A. Heidemann (ILL)	IN 1 0
06 01 015	Dynamic disorder in a smectic B phase. J. Doucet (Orsay), H. Hervet (Collège de France) ; F. Volino, A. Heidemann, A. Dianoux (ILL)	IN 10
06 01 016	Collective motions in smectic A phase 1. part : diffraction on a smectic A monodomain S. Lagomarsino, F. Rustichelli, F. Volino (ILL) H. Hervet (orsay)	D 1 B
06 02 006	Quasielastic and inelastic scattering from silver-iodide (AgI) K. Funke (Göttingen) ; J. Kalus (München) ; R.E. Lechner (ILL)	IN 5
06 02 010	$^3He/^4He$ C.J. COOMBS, R.A. Cowley (Edinburg) W. Stirling, R. Scherm ; A.D.B. Woods (ILL)	IN 5
06 02 011	Inelastic scattering from supercooled gallium C.G. Windsor (AERE Harwell) ; L. Bosio (CNRS Paris), E. Schedler (ILL) ;	IN 3
• 06 02 012	Superionic conductors B.E.F. Fender (Oxford) ; G. Stirling (ILL) ;	IN 10
06 02 014	Liquid Rb and dense N_2 gas P.A. Egelstaff, D. Litchinsky, R.K. Hawkings, (Guelph) J. Sucks, W. Glaser (KfA Jülich), W. Drexel, J. Copley (ILL)	IN 4
06 03 003	Small angle neutron scattering studies of concentration fluctuations in the non-metal to metal transition range : solutions of ^7Li in Nd_3 P. Chieux (ILL)	D 11 A
06 03 006	Structural analysis of molten CsCl and AgCl J.Y. Derrien ; J. Dupuy (Villeurbanne)	D 4
06 03 007	Liquid Lithium Alloys. H. Ruppersberg (Saarbrücken) ; H. Egger (ILL) ;	D 4
• 06 03 008	Ag - Ge M.C. Bellissent, M. Roth (ILL)	D 1 B
• 06 03 010	$TeCl_4$ - $SnCl_4$ R. Régis (Orsay) ; H. Egger (ILL) ;	D 4
•• 06 03 012	Measurement of the coherent scattering function near the first quasi-reciprocal lattice point in SiO_2 A.J. Leadbetter (Bristol) ; P. Seyfert (ILL) ;	IN 4
06 03 014	Structural studies of water J.C. Dore, J.H. Clarke, J.T. Wenzel (Kent)	D 5
06 03 016	Structural studies of aqueous solutions J.E. Enderby, R.A. Howe, G.W. Neilson, A.K. Soper (Leicester)	D
06 03 017	Determination of the three partial interference functions of an amorphous CoP ferromagnet by polarized neutron scattering J.M. Bletry (ILL) ; J.F. Sadoc (Orsay)	D 5
06 03 018	The structure factor measurement for liquid D_20 benzene J.C. Dore, J.H. Clarke, G. Walford, J.T. Wenzel, (Kent, Harwell) H. Egger, P. Chieux (ILL) ;	D 4 D 5
• 06 03 019	Molten CuSb alloys W. Knoll (ILL) ;	D 4
06 03 022	Structure of amorphous PdSi Dixmier, Sadoc, (Orsay) ; Blétry (ILL)	D 4
06 03 023	Structure of amorphous NiP Dixmier, Sadoc, (Orsay) ; Blétry (ILL)	D 4
06 03 025	The structure factor for liquid and solid phosphorous J.C. Dore (Kent) ; J.H. Clarke (Harwell)	D 4
06 03 026	The structure factor for liquid bromine and liquid benzene J.C. Dore, G.W. Stanton (Kent) H. Egger (ILL)	D 4
• 06 03 028	Al Si M.C. Bellissent, M. Roth (ILL) ;	D 1 A
06 03 032	Liquid alloys N.H. March (London) ; D.I. Page (AERE Harwell) ;	D 11 A
06 03 033	Pore size distribution in glassy carbon D.F.R. Mildner, (Rutherford) ; J.S. Higgins	D 11 A
• 06 03 040	Ag-Ge M.C. Bellissent, M. Roth (ILL) ;	D 1 B
06 03 042	Structure factor of liquid acetonitrile Zeidler (Karlsruhe) ; P. Chieux (ILL)	D 4

COLLEGE 7

07 01 001	Distribution og magnetic moment in an alloy of Ni 2 % Ti F. Livet, P. Radhakrishna, J. Schweizer (ILL) ;	D 5
07 01 005	Magnetic moments in platinum nickel alloys D. Bloch (CNRS-G), Beille P. Pataud, P. Radhakrishna, W. Just (ILL)	D 7
• 07 01 020	Spin wave stiffness of Ni Fe, Ni V, Ni Cr, Ni Ru F. Gautier (Strasbourg), A. Castets, M. Hennion (ILL)	D 11 A
07 01 022	Small angle neutron scattering	D 11 A

07 05 011 — Au-Fe alloys
B.R. Coles, B.D. Rainford (London)
K. Fischer, P. Radhakrishna, K. Ibel, G. Göltz, M. Roth, F. Mezei, A.P. Murani (ILL)

* 07 01 024 — Diffuse scattering in Pt Ni — D 7
P. Pataud, P. Radhakrishna, W. Just (ILL) ;

07 01 025 — Determination of spin polarization in Pd Heusler alloy — D 5
Y. Ishikawa, K. Tajima (Tohoku), P. Radhakrishna(ILL)

* 07 01 029 — Distribution of the magnetization in $Co_{0,5}$ $Fe_{0,5}$ Si — D 5
F. Mezei, J. Schweizer, V. Jaccarino (ILL)

* 07 01 033 — Spin fluctuations in Pd-Ag alloys — D 11 A
A. Murani, K. Ibel, G. Göltz (ILL) ;

** 07 02 005 — Crystalline electric field determination in (Rare Earth)$_x$ (La, Y)$_{1-x}$ Al_2 compounds — IN 4
W. Drexel, (ILL) ; K. Knorr (Frankfurt) ; H.G. Purwins, E. Walker (Genève) ;

* 07 02 010 — Crystalline electric field measurements in Yb Al_2 and Yb Al_3 — IN 7
K. Knorr (Frankfurt), A. Murani (ILL) ;

07 02 012 — Crystal fields in Rare-Earth-Nickel$_2$ compounds — IN 4
J. Rossat-Mignod (CENG), D. Gignoux (CNRS-G) K. Knorr (Frankfurt) W. Drexel (ILL)

07 02 014 — Crystal field in RNi_5 hexagonal compounds — IN 7
D. Gignoux, D. Givord, R. Lemaire (CNRS-G), A. Murani (ILL)

* 07 02 015 — Crystal field splittings in the «magnetically doped» superconductor La_{3-x} R_x Al — IN 7
J. Mahoney, A. Furrer (Suisse), A. Murani (ILL)

* 07 03 004 — Quantitative determination of the metastable miscibility gap in the Al-Mg-Zn system — D 11 A
V. Gerold (Stuttgart), G. Kostorz (ILL)

07 03 006/9 — Magnetic small angle scattering of neutrons in cold-worked Ni and Fe single crystals — D 11 A
G. Göltz (ILL), H. Scheuer (Jülich), G. Kostorz (ILL)

** 07 03 010 — A powder neutron diffraction study of Lanthanum and Cerium trifluoride. — D 2, D 1 A, D 7
A.K. Cheetham, B.E.F. Fender, A. Wright (Oxford), H. Fuess (ILL)

07 03 011 — Diffuse neutron scattering from irradiated semi-conductors, gallium arsenide — D 11 A
S. Cupta, E.W.J. Mitchell, R.J. Stewart (Reading) G. Kostorz (ILL)

07 03 014 — Neutron observation of defects in almost perfect crystals — D 10, D 16
M. Schlenker, J. Baruchel (CNRS-G)

* 07 03 016 — Neutron low-angle scattering by glasses containing magnetic elements. — D 11 A
J. Zarzycki, F. Larché (Montpellier) ; M. Roth (ILL) ;

07 03 017 — Short range order of carbon vacancies in actinide carbides — D 7
C.H. de Novion (Fontenay), B.E.F. Fender (Oxford) W. Just (ILL)

** 07 03 018 — (Fe,Mn) WO_4 - Chemical demixing and magnetic disorder scattering — D 7, D 11
Ch. Klein, H. Dachs, (Tübingen), W. Just (ILL)

07 03 019 — Precipitation in Al-Zn Alloys — D 11, D 7
G. Kostorz (ILL) ; S. Messoloras, R. Stewart (Reading) ;

* 07 03 020 — Defect clustering in $Fe_{1-x}O$ — D 7
B.E.F. Fender (Oxford), A. Wright ;

* 07 03 026, 07 03 029 — Small angle scattering by pure metals. — D 11 A
A. Freund, G. Kostorz, M. Roth (ILL) ;

* 07 03 031 — Neutron small angle scattering of SiO_2 -NaO_2 glasses in correlation with dielectric relaxation — D 11 A
D. Ravaine, J.L. Souquet (St Martin d'Hères)

07 04 002 — Nuclear magnetic resonance and relaxation of neutron activated short lived nuclei. — SI 6
D. Dubbers, M. Grupp, H. Stöckmann (ILL & Heidelberg) M. Ackermann, H. Grupp, P. Heitjans (Heidelberg) ;

* 07 05 002 — Premartensitic phonon dispersion anomalies in Fe-Ni invars. — IN 3
A. Chamberod (CEN-G) ; G. Kostorz, R. Scherm (ILL) M. Wuttig (University of Missouri) ;

* 07 05 003 — Measurement of dispersion curves on neutron irradiated Al. — IN 3
G. Bauer (KFA Jülich), R. Scherm (ILL) ; K. Bönig (FRM Garching) ;

07 05 004 — Magnetic excitations in antiferromagnetic Ni_{1-x} Cox0 — IN 1, IN 4
W. Wagner, D. Tocchetti, B. Hennion (ILL)

07 05 006 — Localized and non-localized vibration modes in zinc-mixed chalcogenides Zn (S, Se, Te) — IN 4
R. Beserman, M. Zigone (Paris), W. Drexel, C. Marti (ILL)

* 07 05 008, 013 — Spin wave studies on Cu_2Mn Al — IN 1
Stringfellow, Ishikawa, D. Tocchetti, Tajima (Wigan)

07 05 012 — Inelastic small angle scattering from $Fe_{65}Ni_{35}$ invar alloy — D 11
Chamberod, S. Komura (Hiroshima), G. Göltz, M. Roth G. Lippmann (Jülich)

** 07 06 001 — Energy Levels of hydrogen and D. in Nb, Ta, V — IN 1
N. Stump, G. Alefeld (München), D. Tocchetti (ILL)

* 07 06 005 — Spectroscopy study of vortex lattices in pure superconducting materials — D 11
R. Kahn (Saclay) ; P. Thorel (ILL) ;

07 06 006, 007 — The motion of hydrogen isotopes in α- palladium hydride — IN 4
C. Zeyen, W. Kley (Ispra) ; W. Drexel, A. Murani (ILL) ;

07 06 010 — The critical point of Deuterium in Niobium — D 11
G. Alefeld, N. Stump, W. Münzing (München), K.IBELL(ILL)

* 07 06 012 — The dynamicsof H in metallic compounds — IN 4
W. Kley (ispra) ; W. Drexel (ILL)

07 06 013 — Investigation of the diffusion mechanism of protons in βNbH — IN 10
A. Heidemann, N. Wakabayashi, B. Alefeld (Jülich)

07 06 017 — The anomalous Debye-Waller factor in Ta (H) — D 7
V. Lottner, A. Heim, B. Alefeld, T. Springer (Jülich)

* 07 06 019 — Phonon dispersion curves of Nb H and Ta-H — IN 3
N. Stump, (Munich) Schedler (ILL)

Measurements of elastic diffuse scattering on the 1. Phase of D_2O ice — D 7
J. Schneider (München) ; W. Just (ILL) ;

Hyperfine interaction in amorphous ferromagnetic cobalt- phosphorous alloys measured by inelastic scattering of neutrons. — IN 10
A. Heidemann (ILL).

COLLEGE 8/9

08 01 003 — Anomalous dispersion of protein structure — D 8
H. Bartunik, E. Duee, H. Fuess, M.S. Lehmann S.A. Mason (ILL)

** 08 02 003 — Low angle neutron studies of chromatin (solutions and gels) — D 8
M. Bradbury, J.P. Baldwin (Portsmouth), S. Bram (Institut Pasteur)

** 08 02 004 — The structure of myoglobin in solution — D 11
K. Ibel, H. Stuhrmann (Mainz)

** 08 02 012 — Determination of quaternary structure of polymerase and ribosomes by label triangulation — D 11
W. Hoppe (München), R.P. May, P. Stoeckel, K. Ibel (ILL)

08 02 014	Bacteriophage Pm2 : structure & hydrogen exchange R. Franklin (Basel), D. Schneider, R. Schaefer K. Ibel (ILL)	D 11 A
08 02 016	Conformation and subunit interaction of ferritin R.R. Crichton (Louvain), M. Koch, H. Stuhrmann (Mainz) J. Haas, K. Ibel (ILL)	D 11 A
08 02 017	H-D exchange experiments on myoglobin & ferritin J. Haas (ILL), H. Stuhrmann (Mainz)	D 11 A
08 02 018	Structure and permeability of human red blood cells H. Stuhrmann, H.W. Wolf (Mainz), J. Haas, K. Ibel (ILL)	D 11 A
08 03 001	Neutron diffraction from tobacco mosaic virus K.C. Holmes, E. Mandelkov (Heidelberg)	D 11 A
08 03 002	See 08 02 003	D 11 A
08 03 003	Structure of collagen G. Jenkin, A. Miller, J.W. White (Oxford) K. Ibel (ILL)	D 11 A
*		
08 05 001	Permeation of D_2O through membrane vesicles and analysis of structure of selectively deuterated bilayers G. Büldt, J. Seelig (Basel)	D 11
**		
08 05 002	Dynamics of paraffin chains in soap water system P. Rigny (Saclay) , J. Charvolin (Orsay), A. Dianoux (ILL)	IN 5
08 05 002 A	A.J. Dianoux (ILL), R. Rigny (Saclay), J. Charvolin (Orsay)	
*		
08 05 004	Myelin membranes D.L. Worcester, Willis (Harwell)	D 11 A
08 05 005	Structure of muscles D. Worcester (Harwell), E.J. O'Brien (London) J.M. Gillis (Louvain), K. Ibel (ILL)	D 11 A
**		
09 01 001	Conformation of polymer molecules in solution G. Jannink, B. Farnoux, J.P. Cotton, R. Ober (Saclay) Benoit, Duval, Duplessix (Strasbourg) J. Higgins (ILL)	D 11 A
09 02 002/8	Polymer chain conformation in the bulk H. Benoit (Strasbourg) ; G. Jannink, J.P. Cotton B. Farnoux, R. Ober (Saclay) ; C. Picot, D. Decker, R. Duplessix, M. Duval (Strasbourg), J. Higgins (ILL)	D 11 A
09 02 005	Conformation of polymers in the amorphous solid state and in concentrated solution by neutron diffraction E.W. Fisher, G. Lieser, M. Steinback, R.G. Kirste, W.A. Kruse K. Ibel (ILL)	D 11 A
09 04 008	Quasielastic scattering from rubbers and gels G. Allen, R.E. Ghosh, W.S. Howells (Manchester) A. Heidemann, J.S. Higgins (ILL)	IN 5 IN 10
09 02 006	Conformation of amorphous and crystalline chains G. Allen, R.E. Ghosh, A: Maconnachie, T. Tanaka (Manchester) J.S. Higgins (ILL)	D 11 A
09 02 007	Domain structure in ionomeric polymers G. Allen (Manchester), J.S. Higgins (ILL) K. Hoelzl, C. Schmidt, W. Drexel (ILL) J. Kalus (Tübingen) ; G. Zerbi (Milan)	D 11 A
**		
09 04 011 A	Quasi elastic scattering on polyethylene T. Peterlin - Neumaier, A. Heidemann, S. Howells (ILL)	IN 10
09 04 012	Dynamics of polymer solutions G. Allen (Manchester) ; G. Jannink (Saclay) G. Weill (Strasbourg) ; J. Higgins (ILL) ;	IN 5 IN 10
*		
09 04 013	Polymer G. Allen (Manchester) ; J. Higgins (ILL) ;	IN 10
*		
09 05 005	Frequency distribution low energies in Nb, etc. K. Ross (Birmingham)	IN 5
*		
09 05 007	Dynamics of hydrogen in alkali host lattices T.W. Waddington (Durham)	IN 4
09 07 001	Quasi elastic scattering from ferrocene and other cyclopentadienyl transition metal compounds T.C. Waddington (Durham) ; A.B. Gardner J. Tomkinson	IN 5
*		
09 07 003	Trifluoro A.C. White, Hayter (ILL)	IN 10
09 07 005/6	Self diffusion of water and amphiphile molecules in lyotropic liquid crystals Self diffusion of tetramethyl ammonium ions in tetra methyl ammonia perfluoro-octanoate water mesophases J.B. Hayter, A. Heidemann (ILL) M. Mortimer (Oxford)	IN 10

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