Bulletin
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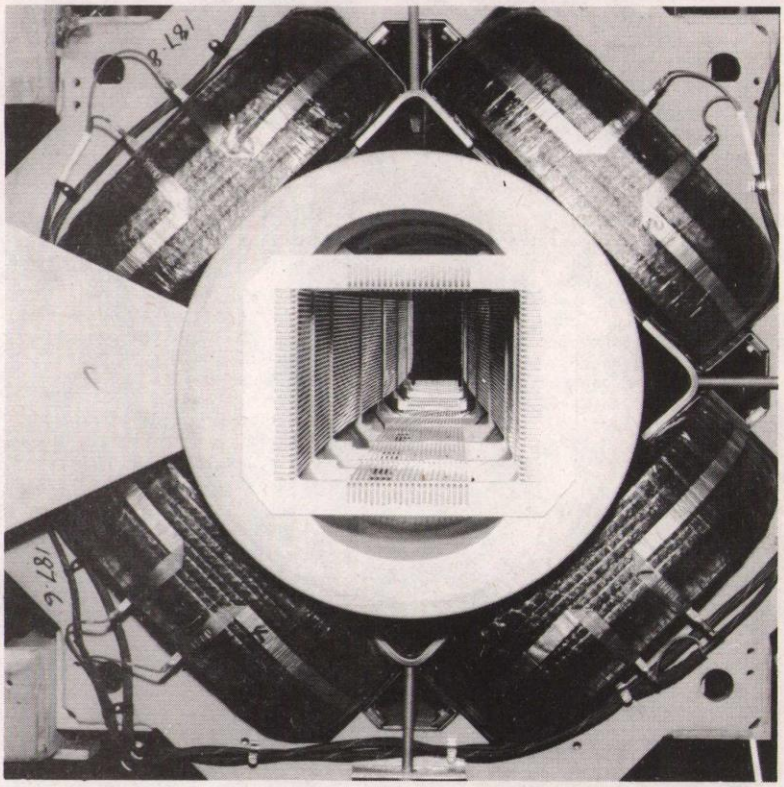
JEAN BAMFORD R20

SNS Radio Frequency Shields



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Recently the first quadrupole shield has been constructed and fitted into its vacuum chamber. All went according to plan, though there were a few anxious moments when one of the frames failed to open fully. The photographs show number 1 shield in place (the profile is clearly visible) and the construction team, Mike Krendler (front) Ray Brown (middle) and Frank Lloyd (back) hard at work on number 2. Numbers 2 and 3 have now been fitted and the assembly area is being set up for the curved sections. Hopefully, our having developed a good feel for the "easy" straight sections will help us to tackle the curved dipole ones.

In the SNS Synchrotron the maximum intensity achievable will probably be determined by coherent beam instabilities. Longitudinal and transverse motions of the proton beam circulating within the synchrotron vacuum chamber induce image currents in the structures surrounding the beam. These currents produce electric and magnetic fields and forces which act back on the circulating beam. If the interaction enhances an original perturbation (for example caused by a slight construction error or other discontinuity), then unstable collective longitudinal and transverse oscillations of the beam can occur, with subsequent beam loss. For the SNS, the frequencies of such unstable oscillations range from 100 kHz upwards. The forces and their effect on the beam depend on the beam energy, beam distributions and beam intensity and also on the strength of the coupling between the beam and the surrounding structure. To maximise the intensity in the synchrotron it is necessary to minimise the beam coupling impedances.

The fast cycling (50 Hz) magnets of the SNS synchrotron are laminated in a direction transverse to the direction of motion of the circulating beam and the induced image currents. These laminated structures surrounding the beam therefore have very high resistive and reactive impedance components and it is necessary to interpose radio frequency shields between the beam and the magnets to screen the beam from the laminated magnet structures and reduce the beam coupling impedances to acceptable values. To be fully effective the shields have to be positioned accurately in the ceramic vacuum vessels and have to follow, as closely as possible, the circulating beam profile.

The design and construction of the shields have presented many problems - solid metal plates can only be used in a few places because of eddy currents, supports have to be made of ceramic to withstand radiation, the shield has to be accurately aligned and supported from the inside of the ceramic vacuum vessel. Of course, the whole structure, handling

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SNS (Cont'd from p.1)

and construction techniques have to be to ultra high vacuum standards!

Solutions

The solution adopted for the quadrupole focusing magnets of the SNS is to make the shields of stainless steel rods parallel to the beam direction. The 3mm dia. rods are supported on spring loaded ceramic (Macor) frames which are contracted to allow insertion of the shield into the vacuum chamber and then expanded (very carefully!) to locate against the inside of the chamber.

Assembly of the shield is done around a specially developed bar fitted with an ingenious hook mechanism controlled by nylon covered 7-strand trace wire (fishermen please note!). For safety the Macor frames are also fitted with retaining plates which are removed just as the shield is inserted into the vacuum vessel.

If there is anyone around who is expert at making hot dogs 5 metres long where the sausages, which have to be fed in from one end, end up centred to 0.1mm, please would they let the Editor know!

Science Museum Open Day

Once a year the Science Museum opens up its transport collection at Wroughton Airfield near Swindon.

The 1982 Open day will take place on Sunday 12 September from 10.00 - 17.30 hrs.

Undercover displays of commercial aircraft, agricultural machinery, commercial vehicles and space rockets are featured, and the outdoor attractions will include working agricultural machinery, vintage fire-fighting equipment, model aircraft, vintage buses, railway equipment and craft demonstrations.

For more details, please ring Jean Banford on Ext 484.

Thanks

Helen Dalton wishes to thank everyone who contributed to her collection and for the lovely bouquet.

"To those I didn't get a chance to see before I left, Cheerio, I shall miss you all."

Janet Dunbar also sends her best wishes to all her old colleagues. She thanks everyone for the generous gift she received on her retirement. It has now turned into patio furniture and she would like you all to try it out. Not all at once - but she'd love to see you.

Computing Seminars

"GRAPHICS AND SPATIALITY IN OFFICE INFORMATION SYSTEMS"

by

Dr Robert Spence

Reader in Electrical Engineering at Imperial College, London

This lecture will take place in the Colloquium, Atlas Centre at 3.15pm on Tuesday 7 September.

A recent trend in Office Information Systems research has explored the value of graphical iconic clues and human spatial memory. This trend will be discussed, not from a technological point of view, but with regard to human factors considerations. The talk will be fully illustrated by videotapes and slides showing examples originating in the USA and UK.

Dr Spence is a Reader in Electrical Engineering at Imperial College, London.

His research interests have ranged from the theory of linear active networks to the computer-aided design of electronic circuits, and are reported in around 80 papers and 5 books. He was co-architect of the MINNIE interactive-graphic system of electronic circuit design, and has recently developed, with his colleagues, a very effective statistically-based approach to tolerance design.

Current activities include a new approach to the teaching of computer-aided design as well as innovations in the area of office information systems. Dr Spence is a Fellow of both the IEE and IEEE, and was until recently co-editor of the IEE Proceedings Part G.

Coffee at Cosener's

Calling all Rutherford Appleton wives! If you have some time to spare, why not come along once a month to Cosener's House for coffee to meet old friends and make new ones. If you are new to the area or visiting from another country, this is your chance to find out about what goes on in Abingdon and the towns and villages around it. If you have pre-school children, they are welcome too, and there is plenty of room for them at Cosener's House. The first coffee morning after the summer break will be on Tuesday 7th September from 10.30 - 12 noon. For further information, please ring either Rosie Fisher on Abingdon 23844 or Joy McWhirter on Abingdon 20232.

Library Notice

Transparencies from the recent Paris High Energy Physics conference are now available on the conference shelves in the Library.

Nimrod's

One of our younger colleagues, Cathy Costain, realising that her generation at RAL had little idea of its history, sought to remedy this situation. The editor is grateful to her for allowing this, much condensed, version of her research to be featured in this edition.

Twenty five years ago it became clear that universities could no longer individually finance the powerful machines needed for their research into the nature of the atom and the basic structure of matter. A national facility was needed, and so was born the Rutherford High Energy Laboratory (RHEL), the first laboratory of the National Institute for Nuclear Science (NIRNS).

The role of RHEL was to build and maintain national facilities for university and polytechnic scientific research, available to all university workers as if they were an extension of their own laboratories. Research activities were to be directed by a committee of scientists from all sectors of the research community under the chairmanship of Lord Bridges. Dr T G Pickavance was appointed Director of RHEL, which was established on a site made available by the Atomic Energy Authority.

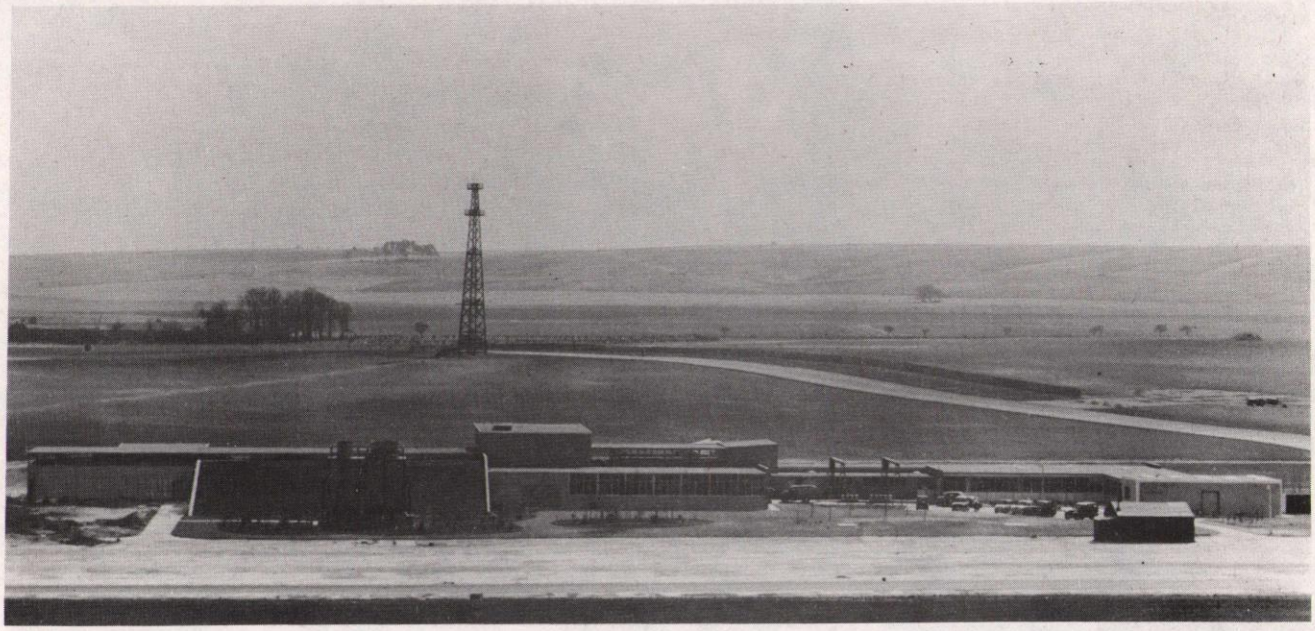
The PLA & Nimrod

The principal feature of the new laboratory was to be a 7 GeV proton synchrotron, the general design of which was approved by the Institute. The Atomic Energy Authority was given the responsibility for the detailed design and construction of the synchrotron. This commission was transferred to RHEL in early 1959. Also inherited from the AEA was a 50 MeV proton linear accelerator in an advanced stage of construction.

From 1960 onwards NIRNS activities increased dramatically. The Proton Linear Accelerator (PLA) was completed and commissioned for experiments in April 1960 and was of great value in the pre-Nimrod era. However, the construction of the 7 GeV accelerator (named Nimrod after the mighty hunter of the Book of Genesis) was the main activity of the Laboratory. The first injection of protons into the completed machine took place on 6th August 1963, and acceleration to 7 GeV was attained about 2 weeks later. Alongside the construction of the accelerator a programme for building equipment for particle physics research was followed. NIRNS funded 3 bubble chambers, a 1.5 metre hydrogen bubble chamber, a 1.5 metre heavy liquid bubble chamber and an 80 centimetre helium bubble chamber.

In 1961, the Institute agreed to manage "a very fast electronic digital computer" - the Ferranti Atlas computer. The Atlas Computer

Kingdom



The site in the Spring 1956.

Laboratory was built adjacent to the RHEL and was eventually merged with the Rutherford Laboratory in 1976.

SRC

As part of the reorganisation of government support of civil scientific research, the Rutherford Laboratory became part of the Science Research Council on 1st April 1965, together with the Radio and Space Research Station (later the Appleton Lab); Royal Greenwich Observatory, and Royal Observatory Edinburgh. Three boards were set up to advise the Council on particular subject areas - 1) Astronomy, Space and Radio, 2) Nuclear Physics and 3) University Science and Technology. When the SRC organisation was modified in 1969 to accommodate the growing importance of engineering, the University Science and Technology Board split into a Science Board and an Engineering Board. (The importance of engineering was further acknowledged when the Council adopted the title, the Science and Engineering Research Council (SERC) in 1981).

1969 saw a change in the Directorship of the Rutherford Laboratory, as Dr T G Pickavance became Director of the Nuclear Physics Division in London Office; his place was taken by Dr G H Stafford.

As Nimrod became older it became apparent that only on an international scale could machines of sufficient energy to further the high energy research programme be funded. The United Kingdom was already involved in the construction of new, more powerful, facilities at the CERN Laboratory, Geneva and it gradually became the role of the Rutherford Laboratory to support the total UK experimental programme at these new European machines. In time the Rutherford Laboratory was also to participate in the colliding beam machine PETRA at DESY, Hamburg.

Diversification

The setting up of the Neutron Beam Research Unit (NBRU) in 1971 restored an area which had been important during the NIRNS era, and also commenced the future diversification of the Laboratory, for in 1973 the UK became a third party with France and Germany in the Institut Laue-Langevin at Grenoble. The increased interest by UK scientists in neutron beam research led to plans for the construction of a high intensity pulsed neutron source at the Rutherford Laboratory. Called the Spallation Neutron Source (SNS), the project is due for completion in 1984 and will constitute a major research facility for the rest of this century.

The Central Laser Facility was set up in 1977 and was upgraded twice, in 1978 and 1981. It is now the most versatile laser in the world. Two new facilities have been added, a high-power electron-beam-pumped gas laser and an ultra-violet radiation facility.

In 1979, yet another facility was inaugurated: the Electron Beam Lithography Facility, which gives universities and polytechnics access to the most sophisticated techniques, for microchip circuit design.

RAL

In 1978 it was decided to merge both the Rutherford and Appleton Laboratories on one site, at Chilton. This decision was based largely on two important factors: the Engineering Board's wish to widen the scope of its radio propagation and communication system work; and the problems of providing proper support for the national space science programme required for the 1980s, from the relatively limited resources available at the Appleton Laboratory. The laboratories were formally merged on 1 September 1980.

Up to Date

Now, a quarter of a century after its inception and under the Directorship of Dr G Manning, RAL's scientific interests span many fields including particle physics, the physics of laser produced plasmas, neutron beam research, geophysics and radio, astrophysics, energy, semiconductors and computing technology.

The design of the ~~SNS~~ ISIS has been completed and about half of the new equipment has been ordered and installation is well under way. The experimental programme is due to start in 1984. Work has continued on space research: the ground station for the Infra-red Astronomical Satellite (IRAS) project is fully installed and ready for launch at the turn of the year; the IUE and Ariel VI (until its decommissioning on 24 February 1982) satellites continued to provide new data; and the Starlink project provides an image processing and data reduction facility for UK astronomers. RAL is also supporting the Solar Maximum Mission, which is observing solar activity and experiments to be launched on the space shuttle facility using Spacelab. The programme of terrestrial research includes studies of the Earth's surface, the oceans and the atmosphere.

Much of this work is done in collaboration with various international agencies, and continues to expand and diversify.

Never to be Forgotten

The week of 26 - 30 July was a sad one for many of us at RAL, for during it we lost at least three well respected colleagues.

Your Editor, having to make the difficult decision on what to report first, is keeping to the convention of 'ladies first'. The fact that most of her mail, copy, photographs etc have come through the hands of Frankie Harris, R20's messenger for the past six years, hasn't influenced her one bit!

Frankie

At Frankie's farewell presentation in the R20 Board Room on 30 July, David Rawlinson made it clear that R20 inmates, plus a few score more, were going to miss her. He had been asked to give a special vote of thanks from all the board members for whom over the years she had supplied creature comforts - she made a wonderful cup of tea. "Thank you on behalf of all your friends and colleagues", he said, "we have this parcel for you and a cheque, but please open the box and let us see what a 'Lladro' is!"

Opening the box, Frankie revealed a delicate Valencia porcelain figurine of a shepherdess, an addition to a large collection of these delightful ornaments that Frankie collects. "Thank you all so much, you are all so kind," she replied, "this is very nerve-wracking, but I have enjoyed being here."

Len

Before NIRNS, before RHEL, before Rutherford Lab, there was Len Goodall - and for much of that time Len has been one of the mainstays of the Lab's Bubble Chamber world. Now after 30 years or so, sadly due to ill health, Len has decided he must leave us, or as Ron Newport remarked more positively, "Len is taking the opportunity to enjoy life more than if he continued in harness."

Naturally the chosen venue (R61 Conference Room) for the send-off organised by Len's many friends and colleagues, was a little tight on space, but as the group's old stamping ground, also very appropriate.

Ron, making the presentation on behalf of all present (and a great many who couldn't be) regailed us with amusing anecdotes of Len's years in the bubble chamber business, from 'high field' to 'rapid cycling' varieties. Len's special field had been optical systems and with optical equipment so costly and desirable, he had invented an alarm system so thief-proof that "even for us to get into the optics lab was almost impossible." In this as in everything else he tackled, Len worked with energy and great enthusiasm. "You have served us very well and we thank you for the pleasure of your company" Ron ended, as he presented Len with a crystal decanter and glasses together with a specially prepared card.

Len replied that he had been dreading the leave-taking, but seeing so many friendly faces had made him feel better. He had enjoyed working at RAL so much. "It is hard to say all I would like to say", he continued "but be sure I shall miss you all very much. But I shall come in to see you all, scrounge a cup of tea and keep up with the news, and if you're passing through Didcot, you're all welcome to call in. Thank you very much indeed, I've been honoured to meet you all."

Jim

R61 Conference Room again suffered severe outward wall pressure on Friday 30 July when Jim Gregory's well-wishers squashed together to say their farewells to another valued friend and colleague.

Jim joined the Lab in 1960, coming from the aircraft industry, where his work as Chief Inspector (aircraft maintenance and inspection) made him eminently qualified to set-up the Nimrod planning and records office. This was an enormous undertaking that required the office to administer up to £1 Million of spares and equipment at times. From Nimrod he transferred in 1976 to EBW to join their planning and records section where he pioneered the computerisation of records. Such was the significance of this contribution, that the system he set up is now expected to run smoothly - even without him.

"On behalf of all friends, colleagues, the division and the Laboratory, we thank you," said David Mann presenting Jim with a watch, a tray incorporating a colour photograph of RAL, a garden umbrella, and the traditional card. "Best wishes for a long and happy retirement."

Jim thanked David for the nice things he had said; his colleagues for their support, and everyone for the gifts and for coming to say goodbye. "I haven't planned what to do yet," he said. "We must taste retirement first and then decide from experience. Thank you all very much."

Bulletin

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