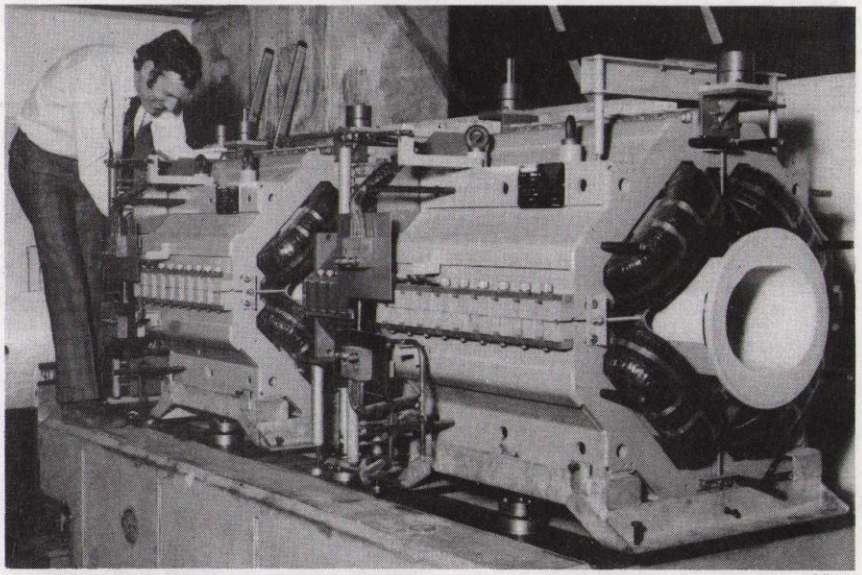
Bulletin
of the Rutherford and Appleton Laboratories 27 April 1981 No. 7.

News from SNS

Quadrupoles

A major component of the SNS ring was recently completed in Hall 1. Two doublet quadrupoles, together with their associated trim quadrupoles and vacuum chamber, have been aligned and mounted on their common steel-reinforced concrete base. When the electrical wiring and cooling water plumbing have been finished, the unit will be ready for installation in the magnet ring.



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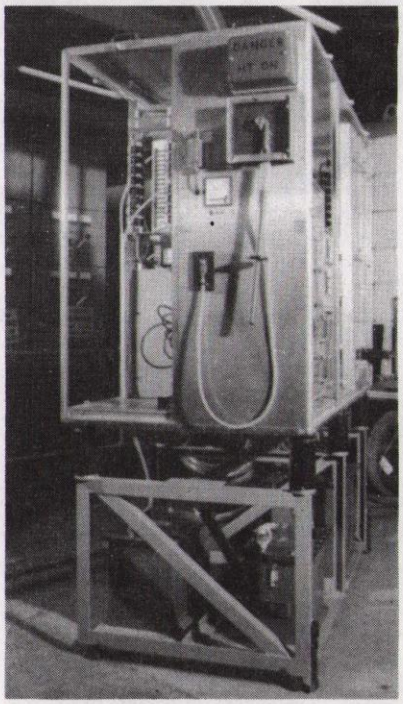
In all, ten of these units are being prepared, together with a spare. Should a magnet develops a serious fault, the complete assembly can be removed and replaced with the spare, this manoeuvre requiring the minimum of realignment.

Extensive Tests

Before assembly on the base, each magnet is tested for water flow, insulation to ground and excessive vibrations under AC conditions. The magnet is then split on the horizontal mid-plane and reassembled to check that alignment does not change significantly. Finally magnetic measurements are taken to establish such important parameters as the integral of the field gradient and any deviation of the magnetic centre from the mechanical centre of the quadrupole aperture; the latter is usually found to be less than 0.04mm.

The four magnets are then set down on pre-aligned kinematic mounts fitted to the base, the upper magnet halves are removed and the ceramic vacuum chamber placed in position. Alignment is checked one more after assembly is complete. We expect that this procedure will enable us to achieve the quadrupole alignment tolerance of ± 0.1mm



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70 MeV Moderator H.T. Platform

The 70 MeV linac was originally designed to give 1 beam pulse per second (p.p.s). It is now being uprated to 50 p.p.s. to make it suitable for use as the injector for the SNS. As part of this uprating work, the rf amplifiers, which provide the rf power to accelerate H^- ions down the linac, are being provided with larger power supplies.

The modulator HT platform shown here is a part of one of the new power supplies. It is capable of producing output pulses of 150A at 30 kV to power an rf amplifier when fed from 38 kV DC. To provide the necessary voltage insulation, the platform is controlled from the ground by fibre optics links. It will soon be used to inject rf power into Tank 1 of the linac.

We thank M R Harold and A Marshall for this news of SNS progress and look forward to hearing from other SNS projects in future issues.

INTERNAL Events

RAL LECTURE
LECTURE THEATRE - 1515 hrs

30 April — M J Rycroft/ British Antarctic Survey
'Studies of the Antarctic Atmosphere'

NIMROD LECTURES
R61 CONF. RM - 1400 hrs

27 Apr - Dr A Ali/DESY
'Implications for Dynamical Symmetry Breaking for e^+e^- Annihilation'.

HEP TECHNIQUES SEMINARS
R61 CONF. RM

30 Apr 1500 hrs — Mr M Main
'The ADA Programming Language

7 May 1400 hrs — Mr D F Parker
'Fortran Optimisation'

ASTROPHYSICS SEMINARS
CONF RM R61 - 1400 hrs

29 April — Dr Paul Murden/RGO
'Cosmic X-ray Background from Faint Sources - Quasars and Halo Stars'

SCIENTIFIC DISCUSSION MEETINGS
R12 CONF. RM - 1515 hrs

28 Apr — Dr J Harries and Dr L Thomas/ RAL
'Middle Atmosphere Studies'

EXTERNAL Events

THEOR. PHYS SEMINARS
TPD - HARWELL - 1400 hrs

28 Apr — Prof. A J Leggett/Sussex
'Quantum Tunnelling on a Macroscopic Scale'

12 May — Dr J D Speight/P.O. Research Centre
No title.

NPD COLLOQUIUM
CONF RM H8 - HARWELL - 1530 hrs

7 May — Dr D A Greenhalg/AERE
'CARS - Spectroscopy for Gas Phase Diagnostics'

THEO. ELEM. PART. PHYS. SEMINARS
DAMPT - CAMBRIDGE - 1500 hrs

1 May — M Ninomiyah/RAL
'No-go Theorem for Weak Interaction or Chiral Invariant QCD on a Lattice'

THEO. PHYS SEMINARS
QMC - 1615 hrs

11 May — Dr G Sachrajda/Southampton
'Some Thoughts on the Gauge Hierarchy Problem'

CHERWELL - SIMON LECTURE
ZOOLOGY BLDG - OXFORD - 1630 hrs

8 May — Prof W K H Panofsky/ Stanford
'Particle Sub-structure: a Common Thread of Discovery in this Century'

PHYSICS COLLOQUIA
CLARENDON LAB - OXFORD - 1515 hrs

1 May — Dr D Noble/Oxford
'Models of Cardiac Rhythm'

Lecture Theatre - 1515 - 14 May

SEARCHING FOR THE INTELLIGENT INDUSTRIAL ROBOT
by
P G Davey

The application of industrial robots is in its infancy. The promise of robotics research is to produce industrial machines more adaptable by far than those existing now. The research involves an attractive spectrum of engineering disciplines. A common factor underlying most research topics is the need to solve complex problems efficiently in small computers. Current research directions in UK and abroad are discussed, using robotic arc welding of thin steel sheet as a concrete example.

Library Notice

MISSING BOOKS

These books have vanished from the display shelves. We would appreciate their return.

FURMAN ITT - Approximate Methods in Engineering Design

PARKER, G et al - Proc. Royal Inst. Great Britain Vol 52

WADSWORTH, N - 280 Software Gourmet Guide and Cookbook

Film Badge Notice

It is period 5, Colour Strip ORANGE. Please check that you are wearing the correct film badge and ALL old ones are returned.

Next Film Change - Monday 18 May

Obituary

It is with great regret that we record the untimely death on 15 April of Dick Scher of SNS Division. Dick, who was 57, joined the Nimrod Vacuum Group in 1961 and was involved in the vacuum testing of Nimrod. He spent 3 years in the Calibration Laboratory before being appointed one of the Vacuum and Radiation Shift Foremen, a post which he held for the last ten years of Nimrod's life. He combined his personal interest in computing with his knowledge of the vacuum equipment to help prepare for and finally dispose of that equipment to schools and universities before achieving his goal of working full time in the computing field, planning for the control system of the SNS. His quiet and conscientious contribution to the life of the Lab will be sadly missed.

An Austrian by birth, Dick came to this country in his early teens, alone, without family or friends. Although he spoke little of that time in his life, it was clear that he greatly appreciated the opportunity he was given here to rebuild his life, to find work, a home and family, and, as evidenced by their presence at his funeral, many friends.

To his wife Daphne and daughter Phillipa we offer our most sincere sympathy.

Quark 'Generation Game'

Particle Physics is the relentless pursuit to uncover the laws of Nature. So far four forces of Nature have shown up which, in increasing order of strength, are called *gravitation, weak, electromagnetic* and *strong*. It is the hope that one day it will be possible to combine these forces into one scheme - the grand unified theories. Indeed, the electromagnetic and weak forces have already been shown to be a different manifestations of a single force - the "electro-weak" force. For this work, Professors Glashow, Salam and Weinberg received the Nobel Prize for Physics in 1979.

A new analysis of results on electron-positron collisions from the JADE experiment (the DESY-Hamburg-Heidelberg-Lancaster-Manchester-Rutherford-Tokyo collaboration) touches on many of the untested aspects of these ideas. Using the PETRA storage ring facility in Hamburg, JADE has made a careful measurement of the total cross-section for the process:

electrons + positrons → hadrons

which is believed to proceed via the production of a pair of fundamental quarks:

$e^+ e^-$ → quark + antiquark → hadrons

Lepton Pairs:

$$\begin{pmatrix} \text{electron} \\ \nu_e \end{pmatrix} \quad \begin{pmatrix} \text{muon} \\ \nu_\mu \end{pmatrix} \quad \begin{pmatrix} \text{tau} \\ \nu_\tau \end{pmatrix} \quad \ldots$$

Quark Pairs:

$$\begin{pmatrix} \text{up} \\ \text{down} \end{pmatrix} \quad \begin{pmatrix} \text{charm} \\ \text{strange} \end{pmatrix} \quad \begin{pmatrix} \text{top} \\ \text{bottom} \end{pmatrix} \quad \ldots$$

The pairs increase in mass towards the right - but how many pairs remain to be discovered?

Previous experiments have been restricted by the constituents of the proton ("up" and "down" quarks) to studying effects involving the lightest stable quarks. The JADE data provide information on the role played by the heavier (unstable) quarks, namely the "strange", "charmed" and "bottom" quarks in the unified gauge theories.

One of the firm predictions of the Glashow-Salam-Weinberg model is the existence of a neutral particle, the Z^o, which "carries" the weak force. Unlike the carrier of the electromagnetic force (the photon) which has zero mass, the weak force carrier must have a mass of at least 78 GeV if the theory is correct. Previous experiments have studied weak effects where the effective mass of the neutral current is close to zero, a long way from 78 GeV. The JADE experiment, however, was able to look in a new kinematic region where the effective mass was as high as 38 GeV, almost half the expected minimum mass.

The experiment showed that the Glashow-Salam-Weinberg model still holds up in this new mass domain - and that the model is still valid when applied to the heavier quarks. The long established curiosity - that the muon is just a heavy clone of the electron - seems to have a general application to the generations of quarks as well. For example, the "bottom" and "strange" quarks are successively heavier clones of the "down" quark, and the "charmed" quark is a heavy replica of the "up" quark. An important question which arises from all this - "*exactly how many generations or clones are there*?" - remains for future experiments to answer.

(We thank Robin Marshall for this interesting news from JADE)

National Safe Driving Awards

The Royal Society for the Prevention of Accidents, has made the following awards to the following RAL drivers:

H G Paterson	- 2nd and 3rd Year Silver Bars to 20 Year Medal and 24 Year Badge (24 accident free years)
E A Smith	- 1st and 2nd Year Bar to 15 Year Medal and 18 Year Badge (18 years)
J Culley	- 4th Year Bar to 10 Year Medal, 15 Year Medal, 16 Year Badge (16 Years)
D A Stock	- 2nd and 3rd Year Bar to 10 Year Medal, 14 Year Badge (14 Years)
A H J Hill	- 1st Year Bar to 10 Year Medal, 12 Year Badge (12 Years)
P R Brown) M D Fitzgerald)	- Diplomas for 1979 and 1980.

Congratulations to you all.

Mark Carlisle at CERN

Dr Herwig Schopper, Director General CERN, explains to Mr Mark Carlisle, Secretary of State for Education and Science the possible location of the LEP tunnel, on a map of the general region. Behind Mr Carlisle on the right are Mr C M Regan of the Department of Education and Science, and Dr Erwin Gabathuler (RAL) at present a member of the CERN Directorate.

During his visit Mr Carlisle also toured the UA1 experiment (see Bulletin 1, 1981) which is well up to schedule, ready for insertion into the proton-antiproton colliding beam facility, when the SPS (Super Proton Synchrotron) conversion is completed. *Photo: CERN*

Mr Atlas Retires

Jim and Elizabeth Hailstone (flanked by Drs Stafford and Manning) delighted with their gifts. 35365

"Lucky Jim" Jim Hailstone called himself at his retirement presentation ceremony on Tuesday 31 March, but it is often said that we make our own luck - the result of application, decisiveness and hard work.

At the end of his war-time service with the RAF Jim took the opportunity to read Economics and statistics at the London School of Economics, graduating in 1950. Out cycling one day he saw the sign of Maths Division NPL, popped in to ask for a job, and in December started as Assistant Experimental Officer. With the statistics group he moved to the Ministry of Supply in the Haymarket and in 1955 to Harwell to run a computing group in Theoretical Physics. The group carried out Monte Carlo calculations using punch card machines, and Jim showed the manufacturers how versatile they could be. Promoted again in 1960, he continued to organise computing at Harwell on the IBM Stretch and Mercury.

Joining NIRNS at the formation of the Atlas Laboratory in 1963, Jim was responsible for the building to house the Atlas Computer. This machine was so large that he had to find a way of loading 29 lorries in such a way, that should an accident occur, we ended up with a machine of some sort! As Head of Department he was the architect of the Atlas Computing Service, and Jim's blue print for computer centres is still widely used. The early years of Atlas were troublesome and in 1965 Jim issued the ultimatum to ICL - until the machine works operations will be discontinued. From that day Atlas never looked back - mainly due to Jim's persistence and effort.

Through the demise of Atlas, upgrades, regrades the merger of Atlas with Rutherford Lab and the setting up of the Interactive Computing Facility, Jim played his part. His interest in Statistics is deep and growing and as a Fellow of the Royal Statistical Society, no doubt we will hear of some of his pet theories now he has more time.

So, at the end of a long and successful career Jim and his wife, Elizabeth, stood in 'his' Atlas Centre Colloquium amongst his many friends, and was wished all success for the future by Dr Geoff Manning, who also presented Jim with a crystal decanter - a token of esteem from all his friends and colleagues. As a momento of his major role in setting up the Centre, he was also given a specially constructed model of the Atlas building. Mrs Hailstone received a large bouquet of flowers.

"I haven't prepared any transparencies, but I have made my notes on punch cards" replied Jim. "Thank you all, I have enjoyed my time here and have appreciated the team spirit of the past 18 years. There have been four 'golden ages' in my career in computing and in the next ten years there will be many more. You have an exciting future ahead. There is a sadness in leaving - I shall miss the kindness, generosity and throughtfulness I have enjoyed over 30 years. Thank you for coming to see me off".

Art & Craft Exhibition

A REMINDER FOR YOUR DIARY

The exhibition of work by members of the Rutherford and Appleton Laboratories (Chilton) will be held in the R12 Conference Room between 12 noon and 2 pm on the following days:

Tuesday 30 June
Wednesday 1 July + evening 5.15-8 pm
Thursday 2 July

Application forms are available from Myra Gilbert, Room 2.73, R1, Ext 6143

Committee for the exhibition:

Jenny Coates	R12	-	Ext 430
Myra Gilbert	R1	-	Ext 6143
Jan Aird	R66	-	Ext 349
Daphne Barrand	R1	-	Ext 6172
Joan Juggins	R25	-	Ext 6206
Elaine Wright	R25	-	Ext 6280

Cricket

The Practice Wicket is now ready and members can begin re-discovering their lost skills with bat and ball most fine lunch times. There will also be practice on dry Tuesday evenings beginning 5.30 Tuesday 28 April. The first friendly match is on 29 April and the League programme begins on 13 May.

Thanks

David E Gray would like to thank all his old friends and colleagues for their good wishes and gifts on the occasion of his retirement. He still hopes to see many of you from time to time.

Missing

Would anyone knowing the whereabouts of a locked tool box last seen in Experimental Hall 1 (R6) on 24 March 1981, please contact J Sexton, Ext. 6223.

Les Coulter of R66 would like the person who borrowed (without his permission) his CASIO pocket calculator, to return it immediately.

Bulletin

Editor: Jean Banford
Building R20
Rutherford and Appleton Laboratories
Chilton, Didcot, Oxon OX11 0QX
Abingdon (0235) 21900 ext 484

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