Bulletin
of the Rutherford Appleton Laboratory
31 Jan 1984 No2

SNS Achieves Vacuum Goal

The ultra-high vacuum system of the SNS Synchrotron achieved its design pressure of 5 x 10^{-7} Torr within 2 weeks of the final joint being made. Consisting of 100 m of glass bonded alumina ceramic and 60 m of stainless steel tubing and with 500 metal sealed demountable joints, it was a major task to search for leaks, particularly since there are no valves in the ring which means that it must be treated as one giant system. In fact there have been remarkably few significant leaks - about 20 - a tribute to the workmanship of the RAL staff who assembled the ring and the meticulous care taken by the vacuum section in testing components before assembly. Scrupulous attention to cleanliness has paid off and the 40 ion pumps distributed around the ring have unhesitatingly started after roughing down to 10^{-3} Torr with a combination of carbon rotary vane, sorption and turbomolecular pump units. Pressures of 10^{-6} Torr are obtained in only 2 hours from pumping down from atmosphere. After a few days, pressures are already heading for 1 x 10^{-8} Torr.

Celebrating the achievement of vacuum pressure below 5 x 10^{-7} Torr in the SNS Synchrotron are: left to right, Roger Bennett, Wally Stanbrook, Bob Hall, Peter Parry, Richard Coleman, Jim Dossett, Max Paley, Derek Whittle, Ken Louch and Bob Elsey. (84RB1115).

and, Circulating Beam at First Attempt

Following the success with the vacuum equipment the next step was to establish a circulating beam in the synchrotron.

Before trying to inject and circulate a beam in the synchrotron however, there still remained a whole host of equipment to connect up and commission. These included the four high power pulsed dipole magnets in the injection system together with the large and complex power supply housed in R4, the main magnet ring with all water cooling services, the DC power supply for the magnet ring, the trim quadrupoles with their programmed power supplies, the diagnostic equipment needed to detect and measure the position of the circulating beam, the safety interlock system and the computer control system. Much of the equipment had never been power tested before because of unavailability of suitable loads or power supplies.

It is a measure of the tremendous effort put in by everyone on the SNS that by the rather ominous date of Friday 13th January we were ready to try to inject and circulate a beam. Most of the equipment was even under computer control.

The Friday evening and Saturday were devoted to turning up the 70 MeV Linac and the H^- transport system to the synchrotron. At the input to the synchrotron the negative ions are stripped of electrons to produce a proton beam. At 1510 hrs on Sunday 15th January the proton beam was successfully injected and a circulating beam established and observed for some 300 turns.

This is a great step forward for the SNS and to achieve a circulating beam at the first attempt reflects very favourably on the quality of the equipment and the care and precision with which it has been installed.

New Year Honours

Congratulations to our colleagues of the SERC past and present who have been awarded honours in this years list.

Professor I Butterworth FRS, Imperial College, former member of Council and Chairman of the Nuclear Physics Board becomes a CBE; Professor J L Jinks, Birmingham, former member of Council and Chairman of the Science Board also becomes a CBE as does Dr H Rose, 'Foseco Minsep,' member of Teaching Company Management Committee.

Dr R G P Voss, Head of Engineering Division becomes an OBE and Mr G J Matthews, ROE, Chairman of Central SERC Staff Side Whitley Council receives the MBE.

INTERNAL Events

HEP SEMINARS
R61 CONF ROOM - 1100 hrs.

1 Feb. D Ward/Cambridge
"Recent Results from the UA5 Experiment at the $p\bar{p}$ Collider"

2 Feb W Allison/Oxford
"Summary of the Park City Nucleon Meeting"

8 Feb. A C Davis/Cambridge
"Chiral Symmetry Breaking in QCD - a Continum Approach"

NIMROD LECTURES
R61 CONF ROOM - 1400 hrs.

6 Feb. I Hinchcliffe/UC Berkeley
"Physics at the Super Collider"

13 Feb. S Sewell/RAL
"Photoproduction of Charm at SLAC"

20 Feb. C Vayonakis/Sussex
"On the Scale of Supersymmetry Breaking in Supergravity Models"

22 Feb I G Moss/Newcastle
"Origin of the Universe"

ASTROPHYSICS SEMINARS
R61 CONF ROOM - 1400 hrs.

8 Feb. Dr William Sealey/ROE
"Sea, Sun and Stars: A Personal View of UKIRT"

22 Feb. Dr James Haugh/Glasgow
"Gravitational Waves"

CONDENSED MATTER SEMINARS
R3 CONF ROOM - 1330 hrs.

2 Feb. J Lynn/ILL
"Spin Dynamics of Isotropic Ferromagnets"

7 Feb. T Cosgrove/Bristol
"Experimental Measurements on Configurations of Polymers at Interfaces"

14 Feb. M Key/RAL
"Applications of High Power and Frequency Tunable Lasers at the Central Laser Facility"

21 Feb. C J Humphries/Oxford
"Hole Drilling with the Auger and Bremsstrahlung Without Braking"

28 Feb. P Richmond/ARC, Norwich
"Physics and Chips"

JOINT THEORY SEMINARS
R3 CONF ROOM - 1330 hrs.

9 Feb. G Karl/Oxford
"Quarks, Glue, Proton Decay and All That - Particle Physics for Anti-Particle Physicists"

23 Feb. M A Moore/Manchester
"Dissipation in Quantum Mechanics"

EXTERNAL Events

CENTRAL OFFICE TALKS
CINEMA - SERC SWINDON - 2.30 pm

24 Feb. Mr J Alvey/British Telecom.
"The Challenges for Information Technology Research"

PHYSICS COLLOQUIA
CLARENDON LAB - OXFORD - 1615 hrs.

3 Feb. Dr G Ross/Oxford
"Supersymmetry and Grand Unification"

10 Feb. Dr R J Nicholas/Oxford
"Go Hetero Young Man - Physics in 2-Dimensions"

17 Feb. Prof. R H Dalitz, FRS/Oxford
"Hyperons in Nuclei"

24 Feb. Prof. F H Read/Manchester
"The Atomic Electron-pair"

ELEM PART THEORY SEMINARS
NPL - OXFORD - 1430 hrs.

3 Feb. Prof K T Mahanthappa/Boulder
"A New Superspace Supergravity and the Massive Superspace"

PLASMA PHYSICS SEMINARS
DEPT. ENG. SCIENCE - OXFORD - 1615 hrs.

7 Feb. Dr V E Cosslett/Cambridge
"Interaction Between Electrons and Solids"

14 Feb. Mr M F A Harrison/Culham
Physics of the Plasma Boundary"

21 Feb. Dr P Malkin/Vac. Interr. Ltd
"Vacuum Interruption"

28 Feb. Mr M L Lea/Oxford
"Mass Spectroscopy of Optically Pumped Discharges"

SHEP SEMINARS
SOUTHAMPTON - 1430 hrs.

3 Feb. C Michael/Liverpool
"QCD Flux Tubes from the Lattice"

17 Feb. R Roberts/RAL
"The EMC Effect"

22 Feb. G Karl/Oxford
"Speculations on Proton Decay"

RAL Lectures

The next lecture in this series will take place on Thursday 16 February at 3.15 pm in the Lecture Theatre.

FORCED NON-PERIODIC TILINGS
OF THE PLANE
by
Professor R Penrose
The Mathematical Institute, Oxford

Periodic tilings of the plane (eg with squares, triangles, regular hexagons, or with more complicated shapes such as those of Escher) are familiar. However certain sets of shapes will tile the plane only non-periodically, some of these yielding striking patterns embodying arbitrarily large regions of exact 5-fold symmetry. Some of the underlying theory of these will be presented, the talk being illustrated by a large number of slides.

Computing Seminar

This lecture will take place on Tuesday 7 February in the Atlas Centre Colloquium at 2.pm.

NEW APPLICATIONS OF 'RAPPORT'
by
Lance Dorman, Mike Chiu & Robert Warden
of
Logica

RAPPORT is a leading Relational Database System. It was originally developed by Logica for an MOD application but is now generally available on most manufacturers' computers.

A brief summary of the system will be given, followed by two talks on the wide range of applications suitable for implementation using RAPPORT. Applications to be included are Knowledge Based Systems, Software Engineering and Simulation. A guest speaker from Daresbury Laboratory will discuss their use of RAPPORT.

Any Old Files?

Once more RAL has an Archive, plus an Archivist! Caroline Cooper is now installed in the Library Stack Room Office and is ready for business.

Now is your chance to organise your office. Not that Caroline wishes to become a repository for any old rubbish, but she can relieve you of sorted files, papers, correspondence etc which may have lasting significance to the history of RAL.

She will gradually be working her way round each Division, but meanwhile would be grateful if individuals would contact her if they have such material. Please give her a ring on Ext: 6163 or go and see her.

DELPHI

In September 1983 work began on the world's highest energy electron-positron collider LEP being built at CERN.

Four experiments called ALEPH, DELPHI, OPAL and L3 have been approved for the first stage of LEP and of these the first three have strong UK participation. In the last issue of the Bulletin RAL's involvement in ALEPH was outlined - now we present DELPHI!

Members of the Committee, from left to right are, Dr D E Baynham (Project Scientist), Dr G Petrucci (Delphi Magnet Project Leader), Mr P T M Clee (Solenoid Project Leader), Mr H Desporte (independent member from SACLAY), Dr G Manning (RAL Director and Chairman of the Committee), Dr J J Thresher (Associate Director NP), Professor U Amaldi (Chairman Delphi Executive Committee), Mr M Smith (Chief Contracts Officer, AERE), Dr F Bonaudi (CERN representative), Dr J-P Grillet (CERN Liaison Officer). (83RB5859).

At the beginning of 1983, RAL was asked to produce a design proposal of a superconducting solenoid for one of the LEP experiments known as DELPHI. The proposal submitted was discussed and assessed by an independent committee and resulted in RAL being asked to design and build the solenoid. Throughout the year, discussions were held with CERN to draw up the technical specification and the agreement to carry out the work. On Monday 5 December 1983, the first Solenoid Management Committee meeting was held at RAL.

One of the world's largest superconducting solenoids, its major parameters are a warm bore of 5.2 m diameter, an external diameter of 6.2 m and an overall length of 7.4 m. When located in the surrounding iron yoke, a central magnetic field of 1.2 Tesla is achieved.

To meet the tight specification on the magnetic field homogeneity, in the region of the central detectors, the coil has been designed using the computer program PE2D which has been modified to deal with the representation of the anisotropic iron of the yoke. Further 3D computations are being carried out using the program TOSCA.

The coil consists of a single layer main coil which is electrically in series with a trim coil located at each end. The coils are powered by a 5 KA supply and in addition each trim coil is connected to a 1 KA supply. The coil will be wound with a conductor 24 mm x 4.5 mm consisting of a superconductor imbedded in a high purity aluminium matrix. The aluminium stabilises the conductor during operation and provides protection during a quench when the 100 MJ of stored energy is extracted from the coil in to an external load.

The coil will be wound using an original technique developed at RAL, where the conductor is wound onto the inside of a high strength aluminium alloy cylinder. This has the advantage of supporting the conductor against the magnetic hoop forces in addition to the cylinder acting as the coil winding former.

Indirected cooling will be effected with 2 phase helium, supplied from a closed cycle refrigerator at 4.5 K which passes coolant through tubes attached to the support cylinder. The coil will be thermally insulated from the external environment by a 70K gas cooled shield. The entire assembly is then supported on low heat leak tie rods inside a stainless steel vacuum vessel. The vessel is also required to support the 150 Tonne weight of the central detectors.

The total weight of the solenoid is limited to 80 Tonnes and because of the overall size and weight, the transport to CERN may present some problems.

DELPHI has a time projection chamber for tracking charged particles and uses ring-imaging Cerenkov counters for hadron identification. The electromagnetic calorimeter will be a high density projection chamber, which provides a three-dimensional reconstruction of the development of an electromagnetic shower. Prototype work for the detector took place at RAL. Groups from the UK have major responsibilities for the outer detector (Liverpool) for the muon chamber (Oxford), and for the data acquisition system and on-line computing (Oxford and RAL).

Missing

Would the person/persons who removed a seven foot grey steel cupboard from the old R9 Workshop, which contained accessories for the BSA/Churchill Grinder, please contact Mr A C Peters, Ext: 6203.

Mr C E Wakeford has lost the following item:-

CBM Commodore Calculator Type 776M Serial No. 99473.

Information please to him on Ext: 5478.

Film Badge Notice

It is period 2. Colour strip GREEN. Please check you are wearing the correct dosimeter, and that all old ones are returned.

NEXT FILM ISSUE

Monday 27 February

Sales to Employees

The sales of scrap metal and plastics to employees will take place on 3 and 17 February at the R40 Scrap Compound from 12-12.30 pm.

Safety Film

The next safety film in our Winter series is to be shown on Tuesday 14 February at 12.30, 13.00 and 13.30 hrs in the Lecture Theatre.

"DON'T BE A CHARLIE"
"SAFETY IN THE HOME"

Accidents in the home cause more deaths and injuries than those which occur at work. This film demonstrates the need to adopt safe methods of working at home as well as at work.

Parting of the Ways

The year ended on a sad note in certain quarters of RAL when on Friday 30 December two more of our long serving colleagues received our thanks at presentation ceremonies arranged by their colleagues to show their appreciation.

Jock Russell

Jock Russell joined Harwell in 1948 as a driver, and transferred to the Rutherford High Energy Laboratory, as it then was, in November 1962. Jock has therefore witnessed many changes at the Lab over the years - the assimilation of NIRNS into SRC now SERC and more recently the transfer of the Appleton Laboratory to this site.

"I would like to pay tribute to Jock for coping with the consequences of the transfer in such an efficient way", said Dr Jim Valentine who was making the presentation.

"It is no easy task when providing a transport service to satisfy customers and still maintain an efficient reliable and economic operation. Jock has managed to do this very ably. To quote from Kipling 'Transportation is civilisation'. We must therefore conclude that Jock has succeeded in keeping us civilised. On behalf of us all I would like to thank Jock for his effort and help over the years and as a token of our appreciation, I would like to present Jock with this gift."

Thanking all who had contributed to the beautiful brass clock he had received, Jock said that it was a moving experience (groans) parting company after 21 years. He had on the whole enjoyed it. There had of course, been some kicks but more congratulations and he would miss RAL. "I wish you all the best", he said "I shall call in occasionally - to check up on how the job is being run!"

Harry Edwards

Harry came to RAL in 1967 to set up something rare and unique in the UK. In those halcyon days of Bubble chambers some 3½ million feet of film were processed per year. There was much work to be done on photographic sensitometry in ensuring that the physicists had the correct emulsions and processing chemistry and to ensure long runs in perfectly controlled standard conditions. There were 24 supporting staff to be trained on the new complex processing machines which ran on a two-shift system 16 hrs/day. Other experimenters began sending film, from CERN, American labs and other British institutions all asking for this accurate quality control on processing. Harry played a key role in all these aspects of the work.

As the Laboratory's interests diversified, it was realised that no longer could site photography be carried out by Harwell as had been the case to this point; the Photographic Section came into being. Harry's wide experience and theoretical knowledge ensured that the Lab had the services it required from photography.

"All this had been achieved with astonishing loyalty," said Dr Valentine "and we extend our thanks for your very considerable effort on behalf of the Lab. Your friends and colleagues have asked me to present you with this amazing collection of fishing gear, which I do with much pleasure. Good luck for the future."

Harry replied that though he was going with somewhat mixed feelings, he had after all only intended to stay 5 years, and sixteen had slipped by. He now hoped he was leaving early enough to start again - though he hadn't made up his mind at what! He had decided not to decide until he left. He had had some happy times and would miss his customers - some less than others. "Thank you for the wonderful gift, I wish you all well," he ended.

Christian Fellowship

Meetings of the RAL Fellowship take place on Thursdays at 12.30 pm in the R2 Conference Room. All are very welcome.

Programme for February.

Feb.	2	Prayer Meeting - Phil Green
"	9	Bible Study - Dennis Williams
"	16	"Yeldall Manor"-David Partington
"	23	Fellowship meeting of Praise

Fishing Filmshows

The RecSoc Angling Club have made arrangements for showing two fishing films in the Lecture Theatre at lunchtimes 12.30 to 1.0 pm.

On Monday 20 February "Go Barbless" shows angling consultant Mike Prichard using some of his company's new Matchmaster rods to fish in the wilderness of Canada. This European tackle, pitted against the quality fish of this lake-strewn region of North America caught saugers, lake-trout, silver bass and even carp. The tackle as well as the techniques were British and the rods certainly handled the fish.

On Tuesday 21 February "Return to Paradise" - a splendid half hour of angling entertainment.

About 100 years ago a sporting gentleman, F D Barker, began travelling as an angling tourist to a remote part of the West of Ireland. As a result of his fishing he wrote a book 'Anglers Paradise'. In 1976 a party of English fishermen retraced Barker's footsteps, searching out the hidden fishing locations and applying present day angling techniques to catch a wide variety of fresh and saltwater fish.

Thanks

June Scholes sends the following message to all her friends at RAL.

"I would like to thank most sincerely my friends and colleagues at RAL for the beautiful flowers, card and lovely porcelain figurine given to me on my recent retirement.

I also thank those whose prayers and thoughts have helped me so much during the past year. I wish you all good health and happiness for 1984."

Ray Smith of Repro R3 would like to thank all his friends who so generously sponsored him in the Rifle Shoot for Spastics and Guide Dogs. The sum raised was £128.00

Lost

Would anyone finding a stainless steel Parker ball-point pen, lost between the Restaurant and the R1 Coffee Lounge, just after the last issue of the Bulletin went to bed (about 4 Jan) please contact Jean Banford Ext 5484. "I'm tired of writing my copy in blood!"

Bulletin

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