Bulletin
of the Rutherford Appleton Laboratory 1 Dec 1986 No.13

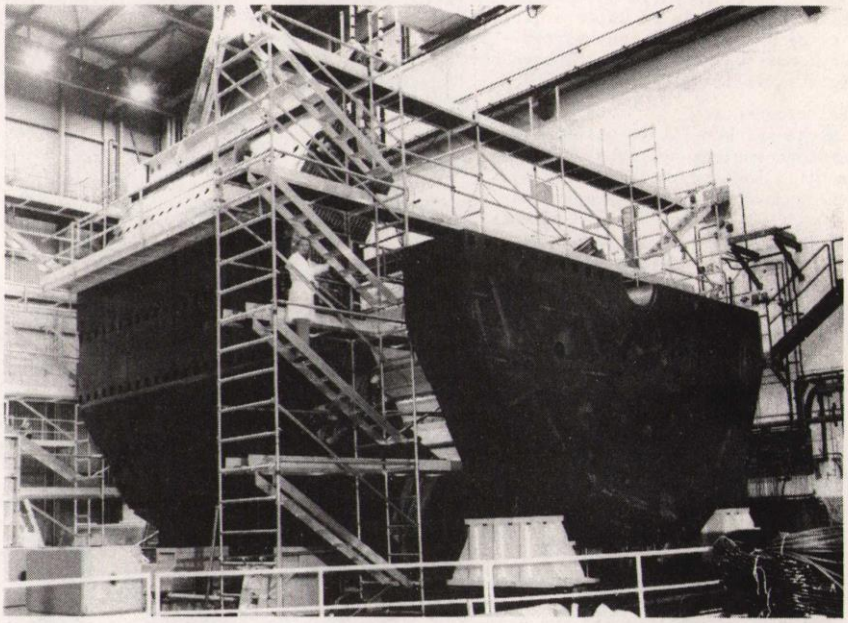
Latest news of LEP

Preparations for first collisions between electron and positron beams at the CERN LEP collider (expected in Spring 1989) are now in full swing.

At CERN the excavations for the 26 kilometre collider ring are almost complete; a section beneath the Jura mountains being the remaining obstacle. On the Meyrin site, the LEP injector has been commissioned, transferring electrons into an accumulator ring at 400 MeV where positron beams will be stored. At four points round the ring, large volumes of rock have been removed to create the zones where the experiments Aleph, Delphi, Opal and L3 will sit.

Work at all the UK participating institutions has moved up a gear and, as at RAL, is beginning to show visible results.

Here we report progress on two of the experiments in which RAL plays a major role, Aleph and Delphi. Opal will receive coverage in a later edition of the Bulletin.



Assembling the laminated end cap and barrel sections of the magnet return yoke of ALEPH at CERN. (Photo CERN)

Aleph detector in construction

The ALEPH experimental zone is a large dome-shaped hall 19m high, 20m wide and 70m long, located 120m below the surface near the French village of Echenevex, 16km by road from the Meyrin site in Switzerland. Some intrepid physicists have already visited this freshly dug cave to gain a foretaste of their future working environment. Fortunately, all the experiments plan to establish their counting rooms on the surface, where in the case of ALEPH, physicists might hope for inspiration from distant views of the Alps.

Approximately half of the UK particle physics community is involved in three LEP experiments. Of the 28 widely scattered institutes which constitute ALEPH, 7 are located in the UK namely in Edinburgh, Glasgow, Imperial College, RAL, Royal Holloway and Bedford New College (RHBNC), and Sheffield. Major projects in the detector construction, data acquisition and off-line software were negotiated within the collaboration by physicists from these institutes.

The prototype phase for the mechanical hardware passed, some 50 UK physicists and engineers are now engaged in the production and testing of apparatus, and related software projects. As the start of LEP draws near, this number will increase towards 70 when more Ph.D students arrive and other physicists complete existing commitments. At present, the majority are working in their UK institutes where the production activity is centred.

However, five UK physicists are already based at CERN engaged in the development of the Data Acquisition system and off-line analysis programs for 'event' reconstruction and Monte Carlo simulation. These projects cross boundaries between the different particle sub-detectors and require a centralised team effort at this phase. Some of these UK physicists have played a leading role in introducing modern software engineering principles to handle the huge increase in complexity of the data structures anticipated.

Physicists based at Lancaster University have made a strong commitment to 3-D graphics programs, essential for displaying individual 'events' reconstructed by the sub-detectors.

ALEPH has wide detection capability but it also concentrates upon precise measurements of electrons and photons even when they are produced inside dense jets of other particles. These measurements are made by detectors which reside within an axial magnetic field of 1.5 T produced by a superconducting solenoid 5.3 m in diameter and 6.3 m long. They consist principally of a central Time Projection Chamber for the recognition and momentum determination of charged particles and a fine grain electromagnetic calorimeter around its periphery which has almost complete angular coverage for photons and electrons from the collision region.

This calorimeter has 74000 elements which has taxed the ingenuity of physicists and engineers at Glasgow University and the Physics Apparatus Group in RAL Instrumentation Division. They have the task of providing 24 sectors of this calorimeter, supported

(see over)

ALEPH *(cont'd from p1)*

by the workshops at Lancaster, RHBNC and Sheffield. The sectors contain 1080 sandwiched assemblies of wire planes, lead sheets and printed circuits, involving the machining of 27000 aluminium extrusions of high tolerances, the stretching of 230,000 fine 25μm diameter wires to the correct tension and soldering 1.1 million connections to the printed circuits.

To date, one quarter of the wire planes have been built and the first sector is about to be calibrated as a fully operational calorimeter using cosmic ray muons in a test facility at RAL.

Energy deposited in the calorimeter is measured as electric charge stored in some 220,000 channels of analogue electronics which is later digitised on transfer to a Fastbus system. To save costs, the electronics have been substantially multiplexed.

RAL electronics group has developed a 16 channel monolithic chip designed in CMOS technology and fabricated in outside industry. If successful, these devices will be adopted saving power consumption, space and money compared with more conventional hybrids which have been developed as a fallback solution.

Another major ALEPH detector is under construction at Imperial College. This is a 2m long cylindrical drift chamber which will be located around the beam vacuum pipe close to the collision region. This will reconstruct charged particle tracks, a few microseconds after an interaction has occurred, to trigger the remainder of the ALEPH detector. Its multi-layered wire readout provides enhanced pattern recognition and reconstruction accuracy for close-by tracks. Special studies have been devoted to mechanical long term reliability and the fast-timing electronics required. This chamber must be available in late 1987 ready for installation tests with the large Time Projection Chamber (TPC) being built at CERN.

The ALEPH physicists at Glasgow and RHBNC have already developed strong links with the TPC. Glasgow are collaborating with Mainz University in West Germany to provide a Neodymium YAG laser system which will beam UV light into the TPC gas volume to create straight tracks by ionisation for calibration purposes. Physicists at RHBNC are constructing a sophisticated electronics processor which will reconstruct rapidly the origin of charged particle tracks from the TPC data. This will remove background interactions unresolved by the Imperial College chamber and hence avoid detailed processing of otherwise unwanted 'events'.

The ALEPH detector costs about 60 MSF (1983 prices) of which the UK is contributing 18% over five years. With the design and procurement phase of this period largely passed, the physicists and engineers look ahead with some excitement at the prospect of performance testing of their final pieces of apparatus followed by real physics in just over two years time.

J C Thompson

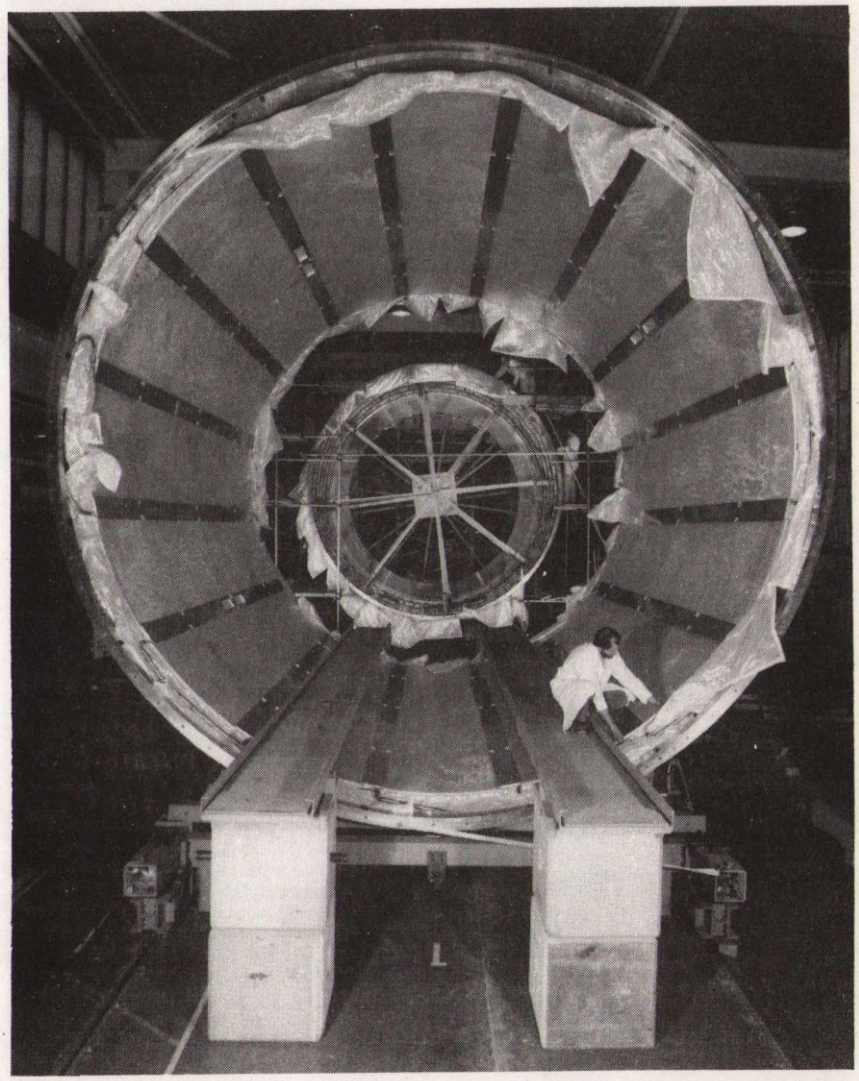
Delphi – superconducting solenoid

Delphi will operate with a magnetic field of 1.2 Tesla in a volume of 145 cubic metres. Power consumption using a conventional solenoid would be about 50 megawatts. The RAL designed superconducting solenoid requires 1 megawatt.

Since signing the agreement with CERN, Instrumentation Division has designed the solenoid, *(Bulletin No. 21984)* developed special techniques for its construction and placed orders with European Industry for those items that could be produced using conventional engineering practices. During the past twelve months all the major mechanical components have been delivered to RAL. The vacuum vessel came from Graz in Austria, the coil support cylinders from Schio in Italy, the 20 km of superconductor from Zurich and the radiation shields from France (apologies to anyone caught in the traffic delays on the A34 from Southampton).

There is now a hive of activity in R40, where the coils are being wound and the cryostat assembled. The solenoid consists of two 30 cm long correction coil modules and four 1.5 m long main coil modules. These are designed with the turns located on the inside of an aluminium alloy cylinder, in order that the cylinder restrains the six atmospheres magnetic pressure resulting from the 5000 amp operating current and 1.2 tesla field. By bonding the turns to the cylinder with glass/epoxy resin and attaching cooling tubes to the outer surface of the aluminium cylinder, the coil can be cooled indirectly to 4.5 K with liquid helium. This design has required the development of a special machine to wind the conductor on the inside of the cylinder.

The winding machine is operating 16 hours per day on a two shift system. The main coil modules have 296 turns which are wound in at two and a half turns per hour. Four 1200 metre lengths and 27 km of insulating tape are used in each module. The conductor is insulated during the winding process



The two concentric shells of the cryostat. 86RC4981.

Suggestions awards

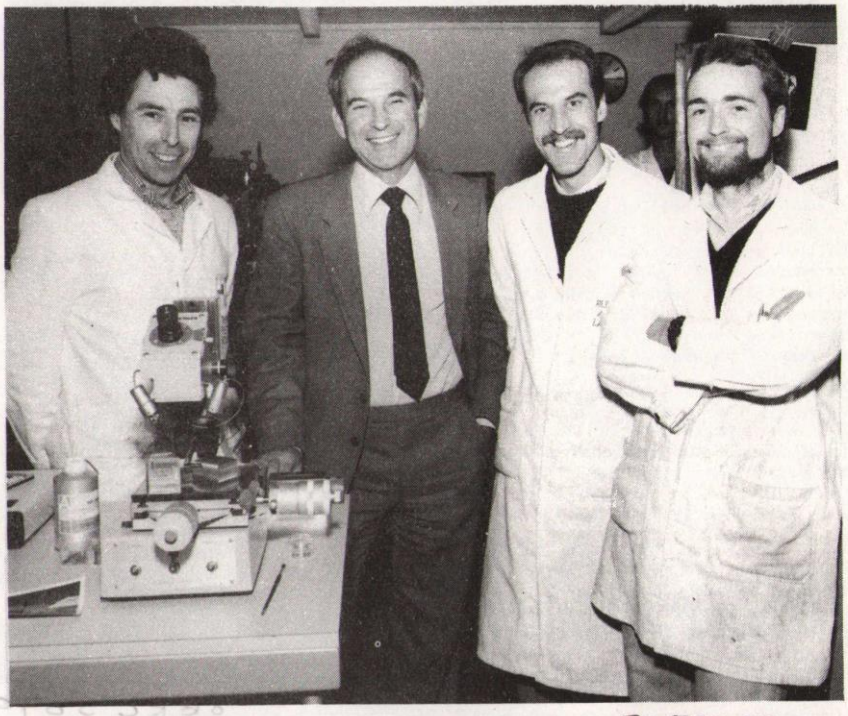
Ingenuity abounds in RAL's workshops.

Working, as they do, on prototypes for a wide range of experimental apparatus, problems are frequently encountered. These are rapidly overcome by the inventiveness of our craftsmen.

The latest crop of ideas attracting Suggestions Awards range from new methods of making tape-joints and locating routing tools for trimming excess fibre glass from the giant Delphi superconducting solenoid shells to the design and production of tools to make 7 micron 'whiskers' for micro-wave devices.

Director Geoff Manning presented five of these awards on Wednesday 12 November. Eamonn Capocci received interim awards totalling £350 for his Delphi ideas. David Bailey and John Spencer's 'whisker' manufacturing method netted them £75 each and David again came up trumps with Nick Ferneyhough for a complex electoform mandrel. £150 each for this brainwave. John also won £200 for designing a special collet-holder.

Dr Manning said that he was always delighted to be able to present the awards personally. "It shows how much I appreciate the work you do - and I do appreciate it. Congratulations to you all," he said.



86RB 52...

86RB 5200.

In the top photograph John, Nick and David explain to Director Geoff Manning how it was done. Pictured below, Eamonn receives his award.

Dr Manning leaving

Off-site readers of the Bulletin will be as stunned as we were to learn of the imminent departure of our Director Dr Geoff Manning. Dr Manning leaves RAL some time in December to become Chairman of Active Memory Technology Ltd (AMT).

AMT was until recently a department of Britain's largest computer manufacturer ICL. The spin-off company will concentrate on making array processors for specialised sectors of the computer market such as scientific users, where massive computing power is needed.

Dr Manning has been Director of the Laboratory since 1979, following 10 years as Deputy Director. Staying on at RAL until retirement would have given him 15 years in post - too long for both the Lab and himself, he thinks. No novice to computing, he was from 1975-1979, in charge of Atlas Computing Division and, from 1980 - 1984 Computing Coordinator for SERC.

Naturally, he will be greatly missed, but his colleagues applaud his enterprise and wish him the best of fortune in his new career. However, this is definately our ultimate contribution to Industry Year '86.

Meanwhile, Dr Paul Williams will be acting Director, RAL and Dr T Gordon Walker becomes Associate Director for Engineering Board in his stead.

Professorship for Bob Dickens

Dr R J (Bob) Dickens has been appointed Honorary Professor in the Department of Applied Mathematics and Astronomy at University College, Cardiff. The appointment is for a period of 5 years and commenced October 1986.

He has also become an Honorary Research Fellow in the Department of Physics at the University of Leeds. This appointment also dates from October 1986, and is for 3 years.

Prize apprentices

RAL apprentices Paul Coombes and Mark Willis received Merit Awards at the Apprentice Prizegiving Ceremony at Harwell on 11 November.

Paul (1st Year Electrical) took his prize in the form of a badminton racquet and Mark (2nd Year Mechanical) acquired a sports bag and an alarm clock.

We congratulate them on their success, as we do A J Bosley, M Westall, T Froud, A C Middleton, N J Meadowcroft, S J Quirk, G J Preston, J Gouldstone, R J Hobin, P A Jerome and P N Wood on all their various examination successes.

Joyce goes too

A bad day in the annals of RAL, Friday 31 October 1986. Not only did we receive news of our Directors departure, but Joyce Eggleton left us too.

Joyce, we were told at her retirement ceremony, arrived at the Lab in 1967 following what presenter Dr Jim Valentine described as 'a flirtation with the armed forces'. (she was a typist for the Royal Engineers at Didcot and then attached to the navy on general nursing duties).

For 20 years Joyce struggled valiantly to uphold the standards of the Lab. In Assets and Inventories (a horrible job for a C.O. according to Joyce) she was "assidious in looking after the Lab's materials and interests" or 'a holy terror'. It depended on your point of view.

In 1980, after 5 years as DAO to HEP division, Joyce went to the RAL liaison office at CERN where she was, in practise, DAO for the entire UK high energy physics community. These duties she performed with a competent flexibility, as your editor found out when dropping in one Monday morning unannounced. A tour of RAL experiments was organised at the drop of a hat - and she took me to lunch.

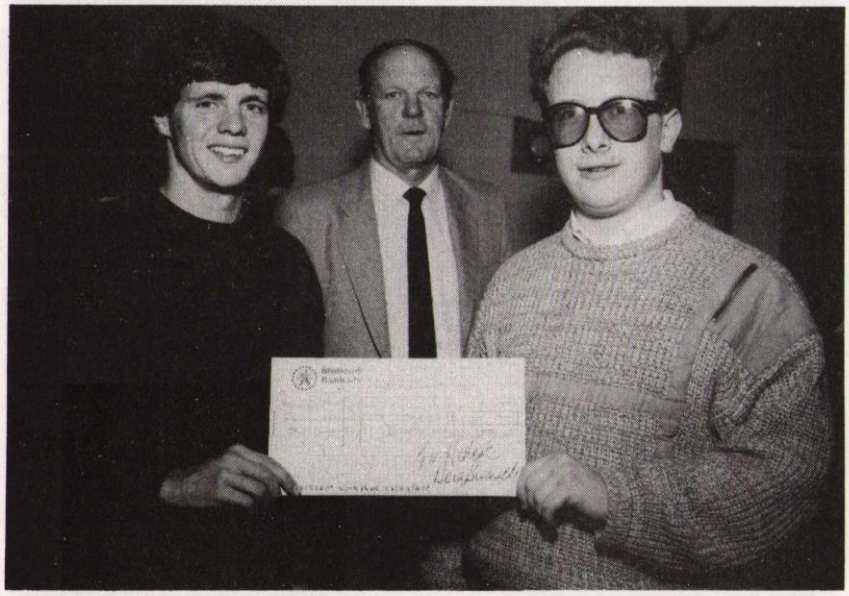
Back at RAL in 1983 as the new DAO for SNS division, Joyce was plummeted into the massive preparations for the ISIS Inauguration. This did produce a few grey hairs.

86RC 5079.

'Joyce is highly thought of', said Jim Valentine presenting her with the gift of a portable stereo radio cassette player from all her colleagues. 'We thank her for all her efforts on our behalf and wish her well for the future'.

Thanking everyone for the most generous gift, Joyce said that she had enjoyed RAL; largely due to the people. She had, she remarked with a smile, tried to train physicists and engineers in the right ways. They had tried to make her more flexible. 'I think we ended honours even'.

Graham's a winner



Graham (right) receives his cheque from player Mark Jones watched over by Doug Buswell.

86RC 5009.

Graham Hall has found rich rewards through supporting RAL's Sunday XI football team. His winning ticket in a Swindon Town FC/RAL Sunday XI fund raising promotion has netted him £500.

Swindon Town mid-field player Mark Jones was at the RecSoc Club House on Tuesday 28 October to present him with the prize. The seller of the winning ticket also receives a prize and security warden Ken Chapman generously donated his £50 to the Sunday XI's team funds. The Swindon Town scheme also boosts team finances by giving a commission on tickets sold by the RAL club.

Club chairman 'Big Brian' Wheeler thanked Mark for coming to present the prizes and Swindon Town for their financial help. Swindon representative Mr Doug Buswell congratulated Graham on his good fortune. Help was mutual, he said.

Graham, a computer science student from Wolverhampton Polytechnic is working at RAL for a year with the Starlink group.

Bulletin

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with double lap glass tape that has been pre-impregnated with epoxy resin. On completion of the winding, the coils are heated to 120°C to cure the resin and bond the conductor turns to the support cylinder. To date the two correction coils and two of the main coil modules have been wound and bonded. Assembly of the first correction coil and a main coil module has started.

To limit the heat input to the 4.5 K liquid helium coolant, the coil is thermally insulated from the external environment. The coil is suspended on low conductivity tie rods inside a stainless steel vacuum vessel. 32 radiation shields attached to the inside surfaces of the vessel are cooled with 80 K helium gas. Superinsulation blankets made up with 30 layers of perforated aluminimised mylor and alternate layers of terylene net are fitted between the vessel and the shields, and the shields and the coil.

The vacuum vessel was delivered to RAL in three sections to ease the transport problem. These sections have been assembled and seal welded to form an integral vessel. The superinsulation blankets and shields have been assembled and the cooling manifolds are being welded in place.

On completion of the assembly the solenoid will be vacuum pumped to the operating pressure and then cooled to a temperature of 80K. This will enable the system to be checked for vacuum and cold leaks, and ensure that the solenoid can be cooled while maintaining the geometric position of the coil.

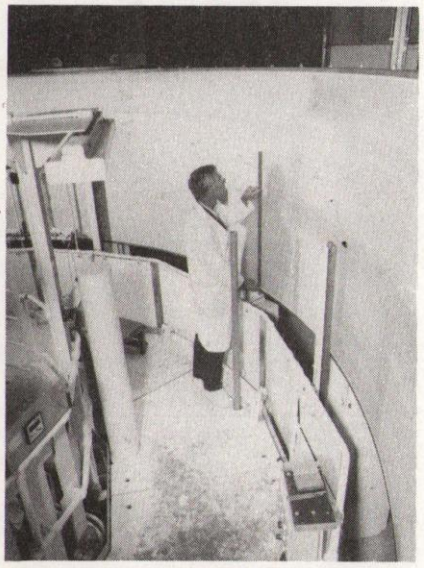
The power supplies and protection equipment have been ordered from industry and will be tested at RAL before shipping to CERN.

The solenoid will be fully automatic in operation, control and protection. This has necessitated the design and development of a purpose built system together with specially written software to carry out the required functions. The system is required to operate the solenoid in a stand alone mode or through the main computer control for the complete experiment.

Scheduled to leave RAL in September 1987 the solenoid will travel by road to Southampton, ship to Rotterdam, barge up the Rhine to Strasbourg and road to CERN. The 6.2 m diameter, 7.4 m long, 84 tonne load constitutes a major transport problem which has resulted in protracted negotiations to arrive at an acceptable route.

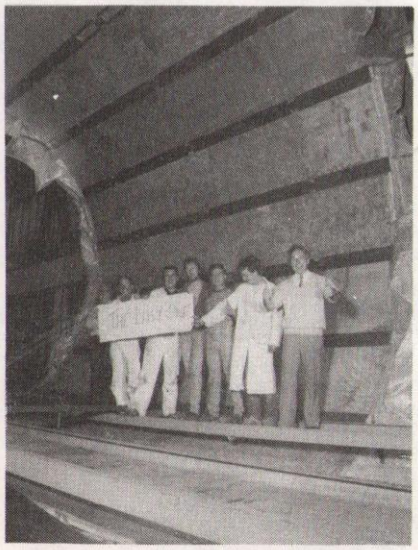
On arrival at CERN, the solenoid will be assembled with the iron yoke, cooled to 4.5 K, with the refrigerator being supplied by CERN, be run up to operating current and the magnetic field mapped. This will be the first time that the team will know whether or not the solenoid will operate in the superconducting mode. For this reason it has been essential throughout the construction period to make many planned tests and inspections, and record all the details of the manufacturing processes to ensure that the solenoid will operate successfully.

P T M CLEE



86RC 4630

Measuring the pitching of the 296 turns wound in a main coil module.



86RC 4628

The last of the 32 shields is assembled.

Internal Events

NEUTRON DIVISION SEMINARS
R3 CONF RM - 1330 hrs

9 Dec. J Chalker/Southampton
'The Quantom Hall effect".

ASTROPHYSICS EVENTS
R61 CONF RM - 1400 hrs

10 Dec. Dr Michael Cruise/RAL
'What will ROSAT see?"

JOAN BANFORD
R20

RAL Lectures

The next lecture in this series will take place on Thursday 4 December 1986 at 3.15 pm in the R22 Lecture Theatre.

"THE INSIDES AND OUTSIDES OF THE PULSARS"

by

Professor Sir Francis Graham Smith,FRS

Astronomer Royal

Jodrell Bank.

In this talk, which reflects his own research interests, the Astronomer Royal will start from scratch and attempt to reach a simple exposition of present research activities in a fascinating area of modern astronomy, the pulsars. Neutron stars, which were once thought of as the inaccessible final stage of stellar evolution, are now seen as a physics laboratory where the conditions are entirely outside the possibilities of our laboratories. Observations of emission, covering more than 50 octaves of the electromagnetic spectrum, can be interpreted in terms of a superfluid interior, and a very complex magnetosphere.

SPECIAL LECTURE

"Space Station and the Future of the US Space Programme"

by

Dr HANS MARK

Chancellor, University of Texas

Friday 12 December

2 pm

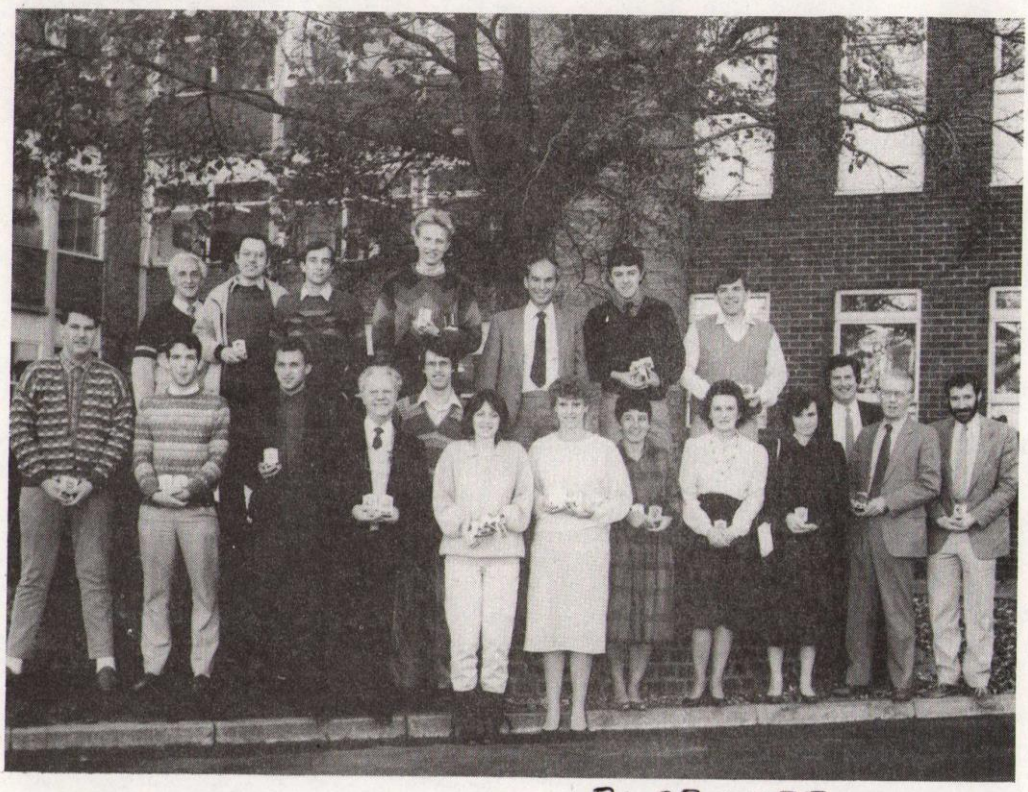
R22 Lecture Theatre

Film Badge Notice

It is period 12 Colour strip YELLOW

Please be sure you are wearing the correct dosimeter and return all beta-gamma films and fast neutron badges promptly.

Sportsday trophy awards 1986



86 RB 5183.

Sportsday trophy winners pictured after a presentation ceremony by RecSoc President Dr Geoff Manning on Wednesday 11 November.

At the ceremony Geoff was given life Membership of the RecSoc in recognition of the support he has always given to the society. For the society, Chairman Tudor Morgan wished Geoff all the best for his new career.

Christian Fellowship

The Fellowship meets in the R2 Conference Room at 12.30 pm every Thursday and visitors are always welcome.

Don't forget the 'Carol Service', which this year will be led by the Rev. Chris Stott, Rector of Harwell Parish Church.

Programme for December.

4 Dec. Bible Study - Mark & Young People

11 Dec. Prayer Meeting - Rodney Tillotson

18 Dec. CAROL SERVICE

19 Dec. Fellowship Christmas Lunch.

Enquiries to Margaret Summers, Ext.5617.

"100 Club" winners

100 Club Winners 1986

Mrs S Fones	£125
J D Gilbert	25
M Yates	25
Mrs F Childs	25
J Cathrew	£125
P Craske	25
R Ellis	25
T Rennie	25
Mrs D Irvine	£125
J Cathrew	25
M Davies	25
Mrs J Banford	£125
T G Walker	25

The club has ten places to be filled. Would anyone who would like to join the 100 Club, please contact: Turdor Morgan in building R18.

Missing

The following items are the subjects of a loss reports. Please contact enquirers with information.

Oscilloscope type CD/1014/2
Label No. X001944

Dr R W Newport Ext 6657

Fluke Multimetre type 75
Serial No. 34851968

Fluke Multimetre type 8021B
Serial No. 2807036

Alan Hopgood Ext. 6633

Thanks

Joyce Eggleton wishes to say thank you to all her colleagues and friends both for their generosity in giving her such super gifts and for putting up with her for 20 years. (Her words). It has been great to know them, and I wish them all the best in the future at work and at play.

Sales to Employees

The sale of scrap materials to RAL employees will take place on Friday 12 December in the R24 Scrap Compound from 1200 - 1230 hrs.

To whom it may concern

Having been here donkey's years I'm used to getting all the stray "Jones" addressed mail, but how the post room got me for this one .....?

Mr. Rutherford Appleton,
Laboratory,
S. & E.R.C.,
Chilton,
Didcot,
Oxon.
OX11 0QX.

Derek Jones