Rutherford Appleton Laboratory
Bulletin

Editor Louise Hall 8 May 1989

Muon Detector for Opal

The final detector system completing the Opal experiment on the LEP machine at CERN is being installed. This detector is designed to measure mu meson tracks in the forward and backward regions from the high energy electron-positron collisions.

Mu mesons, usually called muons, are elementary particles which interact only through the weak and the electromagnetic forces. They behave very much like heavy electrons, and the reason for their mass remains one of nature's mysteries.

We are all bombarded with muons every day of our lives, since the cosmic ray intensity at sea level consists mainly of them. Typically, a muon crosses a centimetre square each minute, so the average person is exposed to several million muons a day.

In the first few years of LEP, the main study will be on the properties of the Z^0, the so called 'neutral intermediate vector boson' of the electroweak theory. LEP will produce millions of these Z^0s a year, and detailed measurements on their decay into muons will provide valuable information for testing current theoretical ideas in particle physics.

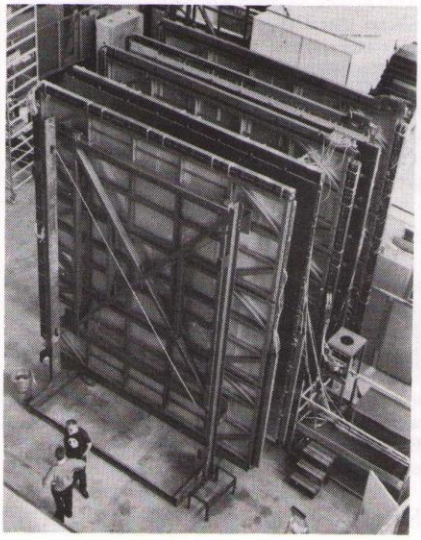
Other new phenomena, like the production of the Higgs boson or supersymmetric particles, should be observable through their decays into muons. In addition heavy quarks, both known (charmed and bottom) and predicted (top), and the W, the 'charged intermediate vector boson' of the electroweak theory, all decay frequently into muons and will be studied at LEP. Muons are clearly a powerful tool for the particle physicist.

So, how to describe the End Cap Muon Detector, which has been a six-year project between Birmingham University and RAL? The detectors can simply be thought of as 6 m long and 8 cm wide poor man's Geiger counters, made from extruded plastic (the principal activity of the plastic supplier is garden hosepipe production).

These are an improved version of chambers (called Larocci chambers) originally designed by an Italian group. Approximately 2500 6 m long units have to be made to complete the detector arrays. To date over three quarters have been made and tested successfully at RAL, where all aspects of chamber production and testing have been undertaken.

Although it is possible to describe them as Geiger counters, they don't actually go 'click-click'. They have a more sophisticated electronic readout system, which locates to an accuracy of 1 mm the discharges inside the chambers by sensing induced charges on 6 m long and 8 mm wide aluminium strips placed on the outside of the chambers. The production of both the readout strip boards and the 40,000 channels of electronics has been done at the University of Birmingham. This readout system is being used by three other Opal detectors.

Well over half of the detectors are now at CERN, being installed on Opal. Since LEP is due to start in July there are not many months left, but we aim to be ready by then.



Five of the end cap muon arrays mounted on their supports at CERN just before installation at the Opal experiment.

Each array is 6 m square, and at each end of Opal the detector stands two arrays high and two wide (13 m x 13 m). What happens if something goes wrong at the top? Yes, we have wondered about that ourselves. Solutions on a postcard please.

Dr R J Homer
University of Birmingham

Howard's Way

Howard Stableford, left, one of the 'Tomorrow's World' presenters, was at RAL in March with a film crew to record an item for transmission in early May, about the ATSR satellite instrument.

ATSR will fly on ESA's ERS-1 satellite, due for launch at the end of 1990. It will measure sea surface temperatures (SST) by scanning the Earth's surface and recording infrared emissions.

Measuring SST is important because changes of only a few degrees can affect climate and weather systems. It will also give scientists precise information which will help to monitor the greenhouse effect.

The flight model of ATSR is at present in Oxford for final testing before delivery to ESA.

Notices

Film Badges

It is period 05, colour strip RED.
Please ensure that you are wearing the correct dosimeter and return all old ones to Health and Safety Group in R12.

Cricket Facilities

The RAL Cricket Pitch and kit will be available for use to RecSoc Members who wish to arrange matches after work. A charge of £6 per game will cover wear and tear. It is hoped to organise the Dave Craddock Cup again this year, but it will depend on the number of teams interested. For more information contact Andy Napper, ext 6349. Please do not use the Cricket Square for anything other than cricket. It takes hours of work to try and keep a reasonable wicket.

Arts and Crafts Exhibition 1989

RecSoc's Arts and Crafts Exhibition will be held from Tuesday to Thursday , 10 to 12 October. Anyone who works at the Laboratory can exhibit their work, be it knitting, woodcarving, painting or whatever. Visitors to the Exhibition will be asked to vote for their favourite exhibit, and the winner will be presented with a trophy.
Entry forms are available from Fran Childs, R68, ext 6499.

Salés to Employees

Sales of scrap material to RAL employees will take place between 12 noon and 12.30 pm in the R24 Scrap Compound on the following Fridays: 12 and 26 May.

Anyone for Tennis?

Enjoy a break from your desk, terminal or bench with a lunchtime or evening session of tennis. New members are welcome to join the RAL Tennis Club for the modest fee of £2. Please contact Peter Nichols Ext 6228, for an application form. Prior membership of the RecSoc is required.

Christian Fellowship: May Programme

11 Visit of an evangelist from Harwell Misssion

18 Bible Study, 'The Grace of God', Meyrick Wyard

Friday 26 Praise and Prayer , R58

Meetings are held in R2 Conference Room (4th floor) at 12.30 pm every Thursday, unless otherwise stated. Visitors are always welcome. Enquiries to Frank Smith, ext 5540.

RAL Lecture: The Greenhouse Effect

On Thursday 11 May Dr John T Houghton of the Met Office will lecture on'The Greenhouse Effect' in the R22 Lecture Theatre, starting at 3.15 pm.

A TALE OF TWO

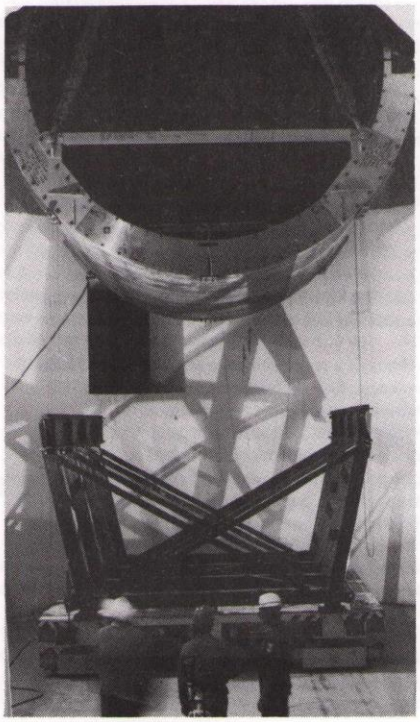
RAL is probably the only laboratory in the world to have designed and built two superconducting solenoids for use in particle physics research.

The DELPHI solenoid is now fully installed at CERN in Geneva, while the H1 solenoid will soon wend its way to DESY in Hamburg.

Here are two reports detailing their progress.

DELPHI Solenoid at CERN

Following the eventful transport of the solenoid from RAL to CERN (reported in the 2 November 1987 Bulletin), an extensive programme of assembly and cryogenic testing has been carried out in the West Experimental Hall.



The solenoid is gently lowered on to the transfer frame.

On 14 June 1988 the solenoid started its last journey to Pit 8 in the LEP Ring. The next day it was lowered down the 100 m deep by 10 m diameter access shaft with only a few centimetres clearance. Everyone was relieved when it appeared at the bottom of the shaft and was gently lowered on to the transfer frame.

The next major move was to transfer the solenoid from the shaft area into the Experimental Hall, and slide the solenoid into the iron yoke barrel. The solenoid was then geometrically aligned on the axis of the iron barrel.

Several months of work followed to assemble the service turrets, located at each end of the solenoid. These enable the current connections and cryogenic pipes to be brought out through slots in the ends of the iron barrel. Connections were then made to the refrigerator (supplied by CERN) and the power supply system.

In January this year the solenoid was cooled to 4.5 K, and after intensive testing the current was raised in steps of 500 amps up to the full 5000 A operating current. This was followed by the mapping of the magnetic field in the bore of the solenoid, which required several runs with different current settings in the end trim coils.

On 8 March the operational requirements were met, and the magnetic field homogeneity was well within the specification. At this point, after a very long and tiring installation programme, the appropriate number of champagne bottles were opened for the team to drink to the success of the project.

The iron yoke and end caps have now been rolled

Another Mammoth Journey

Shortly to begin its snail-like progress from RAL to Southampton en route for Hamburg is the £4 million 6 metre high superconducting H1 solenoid.

For the past three years, a 20-strong team under Project Manager Dr Elwyn Baynham has worked on the design and construction of the 75 tonne magnet device. The solenoid is destined to play a vital part in the international HERA experiment beginning in 1990 at Germany's national laboratory, DESY.

The giant stainless steel ring of the H1 solenoid looks deceptively simple. But sandwiched inside is a complex array of layers which make up the cooling system and the coil cylinder itself, responsible for creating the magnetic field when electricity is passed through it.

Because the coil is superconducting at temperatures of -269^0 C, it can operate with less than 1 megawatt compared with the 30 or 40 megawatts of conventional solenoids.

The finished solenoid has just been successfully tested. So powerful was the magnetic field created during the tests that danger notices had to be put up warning of the effects on pacemakers, credit cards and watches - and the solenoid was running at only 30% of its operating current.

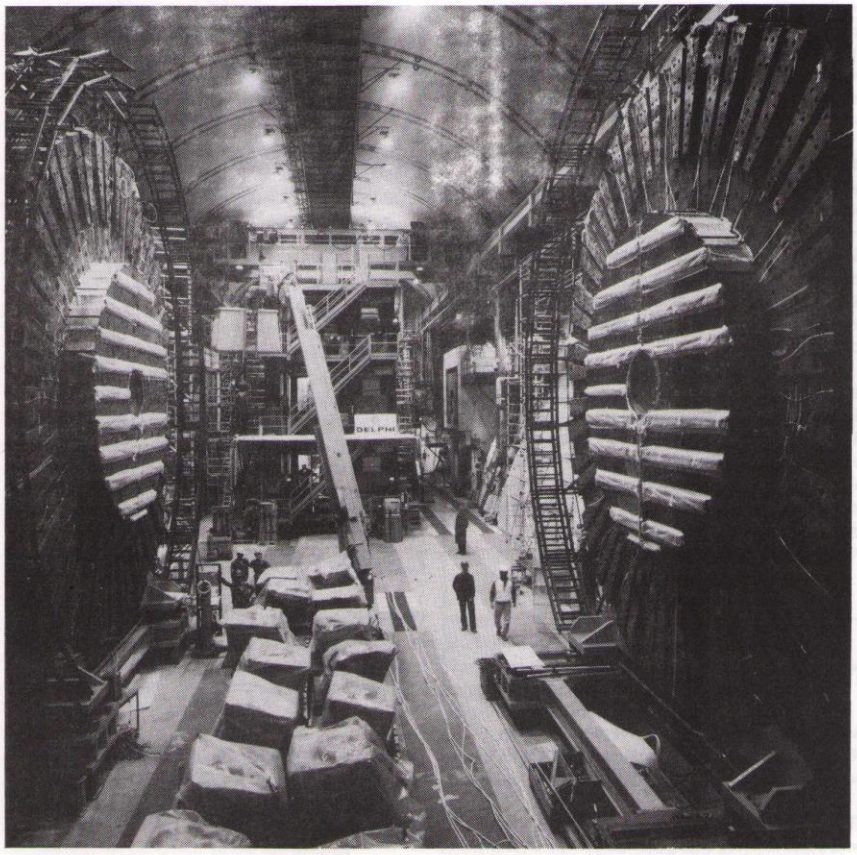
Once installed, the solenoid will be enclosed by an iron yoke to contain the effects of the high magnetic field.

"The HERA experiment at DESY marks the beginning of a new era of particle physics research", said Dr Robin Marshall who is heading the Laboratory's team on HERA.

SOLENOIDS

back and all the other units which fit inside the solenoid bore are being installed. The experiment will then be connected into the LEP Ring, the detectors and accelerator brought into operation,and everyone will look forward to some exciting physics after nearly eight years of thinking, designing, building and installing the equipment.

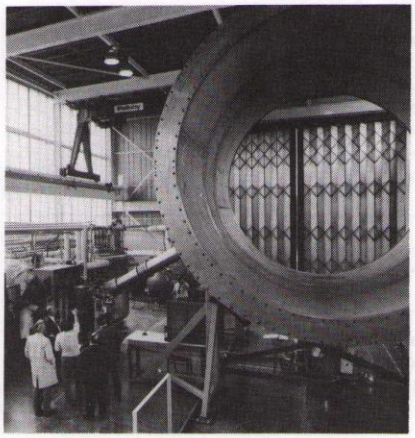
Peter Clee



A view of the West Experimental hall at CERN, showing the solenoid iron yoke and end caps rolled back.

"It will be housed in a 6.3 km tunnel under the suburbs of Hamburg and the H1 experiment will detect the products of high energy collisions between electrons and protons, helping us to understand more about the physical world at the sub-atomic level."

Cost of the solenoid has been shared by the UK's Science and Engineering Research Council (SERC) and Germany. The European Commission has also funded part of the data acquisition work on the experiment.



A group of visitors is dwarfed by the H1 solenoid.

Engineering Council at RAL

Impressed by the engineering expertise, training and facilities at RAL were eleven members of the Engineering Council who were at the Laboratory on 16 March for their annual meeting with the Science and Engineering Research Council.

It was the Engineering Council's first visit to the Laboratory and tours were arranged of the world-leading pulsed neutron source ISIS, the H1 Superconducting Solenoid, and the Microelectronics area.

Seen examining a fastbus card full of microchips are, from l to r, Council Members Mr Michael Manzoni, Chairman of R M Douglas Construction Ltd, and Mr Tim Beynon, headmaster of The Leys School, Cambridge, with Dr Peter Sharp and Mr Jim Stanton of RAL's Electronics Division.

RAL 1988 Annual Report

I am using the pages of the Bulletin to express my personal thanks to everyone involved in the production of the 1988 Annual Report. Clearly Brian Jones and his team played a major part, but so too did the departmental representatives and everyone in the Departments who supported them. I believe that this is the best Annual Report that we have produced for many years; the content, the presentation and the length of the Report are very well judged; there is a good balance of science and technology and organisational/management content, and perhaps the most spectacular achievement is the timing. I had my copy of the Report before the end of March and this must be an all time record. Well done and thank you very much.

Paul R Williams
Director

RAL Drawing Office Code of Practice 1989

On 1 April 1989 a revised code of practice came into effect, superseding the 1972 version. All interested RAL Departments participated in producing the new document which introduced a new numbering system and status markings for drawings; it specifies modification procedures, emphasises line quality and defines new RAL standard blanks for both manual and CAD drawings.

Copies of the Code can be obtained from J A Lidbury, R66, ext 5373, to whom any queries should be addressed.

Einstein for Children

A frequent visitor to RAL who at one time worked on the heavy liquid bubble chamber on Nimrod is Professor Russell Stannard, author of an ambitious book on Einstein's special theory of relativity - aimed at 12 year olds.

The subject is more usually tackled at university level. But Russell Stannard, who is Professor of Physics at the Open University and Vice-President of the Institute of Physics, has strong feelings about getting science, and especially physics, across to youngsters.

To get the message over to young children (and most of the rest of us) meant that the conventional teaching method had to be turned back to front. Instead of beginning with the theory and then explaining its consequences, Professor Stannard looks at the effects first - for example, the faster you go, the heavier you get and the more your time slows down - and only then arrives at the underlying assumptions of the theory.

He also analysed what makes a popular children's book. The end product is 'The Time and Space of Uncle Albert', an adventure story about the girl Gedanken (purposely chosen to encourage more girls to the study of physics) and her uncle Albert, loosely based on Einstein himself.

The book's first print run sold out in 13 weeks, and there are translations in German, Greek and Italian, with more planned.

"The response has been marvellous", says Professor Stannard. "I'm receiving fan letters from children every week, and what's most important to me is that not only are they undertanding the theory, they're actually enjoying it.

"If it could influence even a few children to take up physics I would be delighted. It's a great sadness to me that fewer and fewer people are being attracted to physics worldwide. This was one of the motives behind the writing of the book. Children potentially have a great interest in science and it is up to us to kindle that interest and make sure it grows to a burning flame."

Science for All

Two of the forty young students from Northwood College for Girls in Middlesex who visited the Laboratory in April to find out what the UK is doing in space.

Jeremy Curtis and Carol Nairn guided the two groups of 8 and 9 year olds around the Space Science Department and talked about aspects of their work, while Ray Turner summed up the current state of UK research.

Computing in High Energy Physics

Attendance at the Computing in High Energy Physics Conference held in Oxford from 9 to 14

April was high, with a truly international flavour. Almost 280 delegates from Europe, the USA, Japan and Russia turned their backs on the beckoning sights of Oxford and sat through 35 plenary talks and chose from 48 contributed papers in two afternoons of parallel sessions.

Enjoying the conference dinner are, l to r, Dr Brian Davies and Mr Paul Thompson of Central Computing Department, guest of honour Dr Geoff Manning , and Dr Robin Devenish, Chairman of the Organising Committee.

Accommodation and meals were provided in New College Oxford and lectures were held in nearby St Cross Building lecture rooms.

The lectures reflected the theme of this conference, which was to bring together High Energy Physicists and Computer Scientists, and included talks by well known figures in the HEP community and experts in the area of computer science.

The proceedings of the conference are being published by North Holland and should be available towards the end of the year.

The conference was organised jointly by RAL (with members from Particle Physics and Central Computing Departments) and the Nuclear Physics Laboratory, Oxford. By all accounts it was deemed to be a great success. Next year's conference is being organised by Los Alamos and will take place in Santa Fe, New Mexico. Japan has offered to host the 1991 conference.

Crib Evening

The highly successful annual Crib Evening will be held on Friday 12 May. Singles and Pairs competitions will be played. Fee £1 per head; Refreshments and Bar.

Entries please as soon as possible, with fee, to Peter Craske, R2, or Tony Lubbock, R25.

RAL Lunchtime Crib League: 1988/89

The lunchtime league programme for 1988/89 has just been completed. Ten teams took part, each playing nine home and nine away games. The champions are the Bar Stewards, with 33 points, and the runners up the Live Wires with 31 points.

The Bar Stewards Team are Rob Hambleton (Captain), Colin McEown, John Mackerness and Roley Pussett, and the Live Wires team are Janice Brown (Captain), Geoff Brown, and Tony Rush.

It was another close finish this year, with only five points separating the first five teams. Congratulations to all those taking part.

The knockout competition is now under way, with home and away games right through to the final.

Final Positions

	P	W	L	Pts
1 Bar Stewards	18	12	6	33
2 Live Wires	18	11	7	31
3 Ace Holes	18	10	8	30
4 Setters	18	10	8	30
5 Twentyniners	18	10	8	28
6 Jel Boys	18	10	8	25
7 Jokers	18	8	10	25
8 Perfectors	18	8	10	25
9 The Un-named	18	6	12	23
10 Misfits	18	5	13	20

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