Rutherford Laboratory

24 June - 8 July 1974

bulletin 13

XVII INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS

In recent years this Conference series, first started at the University of Rochester, New York, USA, has rotated between Europe, the USA and the USSR. This year, the UK for the first time is the host country, and the Conference is being held at Imperial College, London with about 800 physicists from over 40 countries attending. In addition a social programme, ranging from a visit to the British Museum Restoration Laboratory to a tour of a famous brewery (completely sold out) has been arranged for the delegates and the 180 wives and 80 children, most of whom will be accommodated in the Imperial College area during the Conference period.

Registration Day is 1 July with an informal get-together in the Conference Centre on that evening and the concluding session is on Wednesday, 10 July.

Since the last Conference, held at Chicago in September 1972, many ideas have been upset; the recent SPEAR etc, results on e^+e^- → multi-hadrons has posed some problems! The interest, ranging from investigations now emerging of the sub-structure of the proton to the existence of weak neutral currents, is likely to produce an invigorating and exciting atmosphere which we hope to report on although owing to space limitations, somewhat briefly.

A pre-conference Planning Meeting will be held at the Rutherford Laboratory on 26, 27 and 28 May, if necessary, continuing on the 29 and 30 May. Some 60 speakers, organisers and scientific secretaries will be making final plans for the conference sessions.

The organisation and staffing of this important conference is being carried out mainly by members of the Laboratory staff and we wish both them and the participants an enjoyable and successful time.

The Accelerator Conference held at SLAC in early May, as expected turned out to be an interesting and lively event. The Editor is indebted to Graham Rees for not only agreeing to report on this conference but for producing such an interesting account. In particular, the expanded section on session 5 where the various forms of beam instabilities, now becoming a common problem on modern accelerators and storage rings, were discussed at length although, it appears, not quite the length of the final invited paper in session 8.

STANFORD - PROBLEMS & PROGRESS

The IXth International Conference on High Energy Accelerators was held at the Stanford Linear Accelerator Center between 2 and 7 May 1974. There were eight main Conference sessions, of which brief details will be given.

The first session included invited talks on the Serpukhov, NAL, SPS and Japanese proton synchrotrons. Of main interest was the steady improvement of the NAL performance over the last year, in which time the intensity has been raised by a factor of ten to reach 10^{13} protons per accelerated pulse. The main limitation now appears to be in the performance of the 8 GeV booster, though phase instabilities of the beam bunches are just beginning to appear in the main ring.

Session 2 covered experimental details of the ISR, SPEAR, DORIS and DCI storage rings. The ISR reported on future plans for developing low-β quadrupole insertions to improve the machine luminosity. SPEAR described the improvement program in which the energy will be increased from 2.5 GeV to 4.5 GeV. This called for a major RF development program, in which the SLAC laboratory has developed its own 358 MHz klystrons. The new storage ring DORIS is still in the process of commissioning. The present performance is limited by three different types of single beam instabilities, which are the subject of further study.

Superconductivity (session 3) included both RF and magnet development programs. There were details of the superconducting RF work at HEPL, Cornell and Karlsruhe, and it was reported that the Cornell synchrotron has successfully accelerated beam with a superconducting RF cavity installed in its ring. In the area of superconducting magnets, there were reports from BNL, GESSS and LBL. Brookhaven described the performance of a pair of dipoles, models for the future storage ring, ISABELLE. The GESSS work covered the testing of the pulsed dipoles at Saclay, Karlsruhe and the Rutherford Laboratory. LBL described the current state of the design of the 4 GeV superconducting proton synchrotron, ESCAR, for which construction should begin in November. In the 4th session were discussions on the state of the art of electron ring accelerators and there was a general air of gloom because of the curtailment of the extensive development program at Berkeley.

The most interesting conference session was the 5th, where collective effects in particle accelerators were discussed. The raporteur was F Mills of NAL, and speakers included R Stiening (NAL), J Gareyte and F Sacherer (CERN PS booster), G Fischer (SPEAR), W Schnell (ISR), E M Rowe (Wisconsin), A Piwinski (Desy), J Buon (Orsay) and M Month (Brookhaven). NAL has observed its high intensity beam develop unstable verticle oscillations, with the bunch shapes staying constant, but each bunch centre moving coherently. It is not possible to cure the effect by making individual particles oscillate at slightly different frequencies, a technique that has been successful on other machines. The narrow permissible band of particle frequencies rules out this solution. NAL has developed feedback systems as a cure. At the CERN PS booster there have been observations of head-tail type instabilities of the bunched beams. The leading edge of a bunch affects the motion of particles near the trailing edge, and some turns later the role is reversed when the trailing particles move to reach the head of the bunch. The different bunch motions are also coupled via the currents that are induced in the resistive walls of the vacuum chamber. The theory of the effect was elegantly explained by Sacherer. All electron storage rings have found that the physical length of the particle bunches are a function of the number of particles per bunch. SPEAR and Wisconsin have made systematic bunch length measurements and have traced the effect to machine components within the vacuum chambers. In the case of SPEAR, the troublesome element was the injection fast kicker magnet, at Wisconsin it was the inflector. All the collective effects reported are of great importance for the design of the next generation of machines.

Session 6 discussed extraction problems and computer control of accelerators. A review of computer control was given by M Crowley-Milling (SPS). The 7th session was devoted to the proposals for the next generation of storage rings, ISABELLE, EPIC, PEP, TRISTAN, and SUPER ADONE. The PEP machine proposal has just been published, and is for a single 15 GeV e± storage ring. The ISABELLE proposal (200 GeV p-p) will

news cont. on pages 3 and 4

INTERNAL EVENTS

NIMROD LECTURE SERIES and HEP SEMINARS

There are no lectures in the Nimrod Series during the next two weeks. H[redacted] Semina may be arranged at short notice during the coming weeks so please watch notice boards for information.

TRADE DEMONSTRATION
Thursday 27 June
10.00 - 1600
East Wing Conference Room, RI

Burroughs Machines Ltd will be demonstrating their new model C7200 programmable printing calculator which is available in three styles with programmable storage areas of 204, 408 and 816 program steps respectively. Being flexible (entirely software-programmed) and inexpensive makes it a useful tool for repeat calculatio The magnetic cards upon which programs are stored can also be used to accumulate and store data from its 16 data-storage memories. Demonstrations will be given using a selction of an extensive soft-ware library already available. Other machines from the Burroughs range will be on show.

SEMINAR IN COMPUTING
Friday 5 July
11.00
Conference Room, Building RI2

H.P.D Reduced Guidance Measurement Systems.

A Bryden

The Reduced Guidance System

The Reduced Guidance System for measurement on HPD of bubble chamber film is bein developed, primarily with the measurement of film from large chambers (eg BEBC) in mind. Results of tests on film from the CERN 2 metre chamber will be presented and a comparison made with the Road Guidance production system. An outline will be given of the problems which are expected to arise with BEBC, and some thoughts will be made on a possible production measurement system for BEBC.

EXTERNAL EVENTS

READING UNIVERSITY

Dept of APPLIED SCIENCES COLLOQUIUM - 16.30 hours
26 June: Thinking Machine: A Physhological Approach - ***John St Quinton***

DARESBURY LABORATORY

DARESBURY SUMMER LECTURE SERIES
29 June-3 July: Low Energy Photo and Electroproduction - ***Dr C Vevzegnassi/ Trieste and Daresbury***

EVENTS AT HARWELL

THEORETICAL PHYSICS SEMINAR/CONFERENCE ROOM, BLDG 8.9 - 1400 hours
25 June: The Renormalization Group and Phase Transitions - ***D J Wallace/Southampt***

NUCLEAR PHYSICS DIVISION COLLOQUIA/CONFERENCE ROOM, HANGAR 8 - 1530 hours
25 June: Pelletrons, Tachyons and other Australian Matters - ***Prof. Sir Earnest Titterton/Australia***
1 July: The Giant Dipole Resonance - ***Dr B L Berman/Univ. of California***

NIMROD SCHEDULE

CYCLE 4 18.6.74 - 9.7.74

MACHINE PHYSICS — HIGH ENERGY PHYSICS

Team	Beam	Experiment	State
CERN/ORSAY/OXFORD	P8I	Hadron-Proton Spin	Data
RUTHERFORD LABORATORY	πII	Beam Measurements	Data
IMPERIAL COLLEGE/RL	π8A	Experiments on Narrow Bosons X^{o} (958) S* and Cross-Section Measurements	Data
BRISTOL/SOTON/RL	KI5A	$K^{-}p$ Differential Cross-Sections	Setting up
COUNTER GROUP B/ CAMBRIDGE UNIVERSITY	πI2	$\pi^{-}p \rightarrow K^{o}\Lambda^{o}$ in the Range 1.4 - 2.0 GeV/c	Setting up
RUTHERFORD LABORATORY	π9	Polarisation in $\pi^{-}p \rightarrow \pi^{o}n$, ηn	Setting up
BIRMINGHAM/SURREY/ RL	KI7	Stopping Kaons	Setting up
OXFORD - ISIS	P7I	Chamber Tests	Setting up

e published shortly, and the EPIC proposal in October of this year.

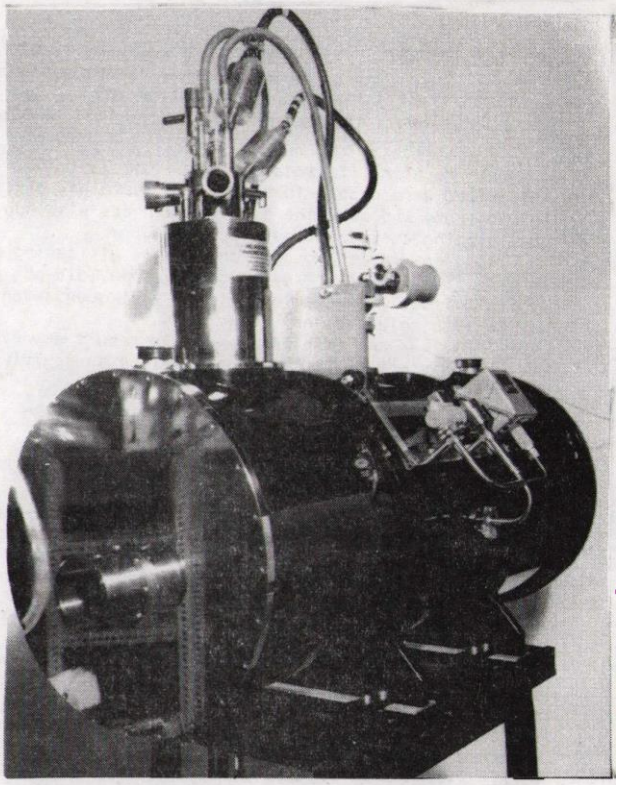
The Conference ended with a series of overall perspective talks. M Gell-Mann discussed trends in elementary particle theory, and was followed by M Lederman who gave his views on what the next generation of machines should be. He favoured very high energy p-p storage rings, but also saw the need for e^+-e^- facilities. E Keil (CERN) then discussed the design of such very high energy p-p and e^+-e^- storage rings, and he outlined the design criteria set by the effects of the beam-beam interaction. This is the space charge force between the two colliding beams which determines the ultimate performance of the machines. The final invited paper was by Ruffini (Princeton) who spoke on 'Astrophysics and High Energy Particles'. His enthusiasms appeared to know no bounds, and he might still be carrying on as far as your reporter is aware.

The Editor is grateful to George Gallagher Daggit for information on the Basque superconducting solenoid.

THE BASQUE SOLENOID As announced in Bulletin No. 12, equipment for the Basque experiment was sent to Vancouver, Canada, on 31 May 1974. An important part of this equipment is the superconducting solenoid which will be used by the Basque experimental team to process the spin axis of the 200-500 MeV polarised protons in a triple scattering experiment on the 'Triumf' cyclotron. The Basque 6 Tesla metre solenoid is the first large, fully operational superconducting magnet to be designed at the Rutherford Laboratory for a particle physics experiment. In constructing the magnet special attention has been paid to operational requirements of simplicity, reliability and economy. It is hoped that experimentalists will find it no more difficult to use than its conventional magnet.

The cryostat which contains the solenoid has a 10cm warm bore, is 1.3m long, 56cm diameter and can be operated unattended for 30 hours between liquid helium refills (liquid nitrogen for the thermal radiation shield is transferred automatically).

Excitation for the 11 Henry solenoid is supplied by a remotely controlled 10V, 270A dc power supply, only required when charging the solenoid from 0 to 210A in 300 seconds. Automatic control, incorporated in this unit, controls the setting, resetting and reversal of the



magnetic field. This enables the direction of spin of incident protons and scattered neutrons to be reversed without interruption to the experiment. A vacuum pump associated with the equipment automatically pumps the cryostat vacuum vessel if the pressure within it rises above 10^{-5} Torr.

A particular feature of a magnet of this type is its low operating cost, £1.25/hour as compared with £30-£60/hour required to operate a convential solenoid meeting the same requirements. What is more the copper solenoid system would have a higher capital cost.

This work which occupied 14 months was carried out by a small team drawn from Applied Physics and Engineering Science Divisions.

POSTAL ADDRESS As from 1 July 1974 the correct postal address of the Laboratory will be:-

Rutherford Laboratory
Chilton
Didcot
Oxon OX11 0QX

To ensure that users of the postal service have an adequate period in which to revise letter headings etc both the new and the old county names will be acceptable until 1 July 1975. Thereafter mail bearing the old county name will be regarded as incorrectly addressed and may be subject to delay. It is now more important to use the postal code.

The address on printed stationery etc. in the Laboratory is being changed as each item comes up for reordering. In addition the figure 2 is being added to the present telephone number in preparation for the change-over of the Abingdon exchange to STD later in the present year. The telephone numbers of the Laboratory will then be Abingdon 21900 and 21991.

All staff are asked to reduce as far as possible in the coming year of transition the office and laboratory stocks of stationery carrying the present Laboratory address so that the change over to the stationery carrying the new address will involve the minimum wastage of paper.

MISSING EQUIPMENT A Wolf 4535 Grindette, 240 volt, was removed from the R2 Nimrod Workshop on Sunday, 9 June. Will the person who removed this tool return it immediately to M R Hall or contact him on Ext. 6223.

RUTHERFORD LABORATORY BULLETIN *Published by the Scientific Administration Group* *Editor:* H F NORRIS

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Deadline for Insertions	GENERAL & SOCIAL NEWS	INTERNAL & EXTERNAL EVENTS
	Tuesday 1600	Wednesday 1200

SOCIAL NEWS

SRC GOLF TOURNEY The weather man was kind to SRC golfers when they recently played the inaugural match for the Sir Brian Flowers Trophy at North Oxford Golf Course.

Despite a brilliant days golf by Bob Taylor, Rutherford were unable to hold off a sustained challenge by Daresbury who were the eventual winners with Appleton just pipping us for second place.

The event was thoroughly enjoyed by all taking part and, despite serious reservations by some, did not prove too calamitously exhausting, if the subsequent events at the 19th hole were any guide.

Altogether and despite the unfair result a very successful start to what we hope will be an eagerly anticipated annual event.

LETTERS OF THANKS Ann and Mark Tyrrell would like to thank all their many friends at the Lab for the wonderful silver tray and goblets and the beautiful bouquet of flowers. All the good wishes were very much appreciated.

Terry Batchellier says - Thanks to all for the super presents I received on my retirement. As lots of you have probably heard, the day after my "last day on pay" I produced a 5lb 7 ouncer, we are calling Helen. Hope I didn't worry too many people using the Grove bus to work. Everyone is welcome to call in. I'd love to see you - regards Terry.

AN OUTSTANDING EFFORT A Rutherford Laboratory team entered the Southern Region Civil Service 5-a-side Indoor Football Competition this year.

On Sunday 28 April, Rutherford entered a Zone Qualifying Competition at Basingstoke and, playing indoor football for the first time, swept the Opposition aside to win their games 6:2, 6:0 and 6:1 to qualify for the finals (i.e. 18 goals in 30 mins playing time). The team consisted of Jeff Bizzell, Steve Farr, Martin Guest, John Holiday and Ron Lawes.

On Sunday 16 June the Rutherford team, consisting of Jeff Bizzell, Steve Farr, Martin Guest, Jeremy Ireson, Ron Lawes and Jim Taylor competed against 11 other finalists and reached the semi-finals by beating Portland 3:2 and Gosport 3:1. In the semi-final Rutherford, despite coming back strongly in the second half, lost to Reading 2:4 who in turn lost 0:3 to a strong team from Weymouth.

However, the Rutherford team, by coming in the top four teams in the South England region, will gain representative honours against other regions later in the year.

CHRISTIAN FELLOWSHIP In these days of both national and personal tradgedies the Christian believes that in all circumstances, 'God is our refuge and strength, a very present help in trouble'. The Rev. W Beddard-Smith, Superintendent of the Wantage and Abingdon Circuit of the Methodist Church will be speaking on this theme at 12.30, R12 Conference Room, Friday 28 June. All are welcome.

Friday 5 July: Barney May of Bldg R2 will be leading our monthly prayer meeting. 12.30, R12 Conference Room.

FROM THE EDITORS (FOREIGN) NOTEBOOK For those readers who have not visited CERN, and there must be a few, some first impressions of this major European Scientific Research Centre may be of interest. The cover photograph of the May issue of the CERN COURIER shows the rural scene at Meyrin near Geneva on 17 May 1954 at the time when site work was beginning for the Laboratory. After two decades the setting as seen looking south-west from the spendid new restaurant or from the viewing gallery at the top of the water tower is still rural. Acres and acres (or should one say hectares!) of vin-yards with the vines breaking into growth provided a pleasant backcloth (the Swiss Alps were very shy, some of the peaks showing themselves very briefly on one morning).

The other side of CERN I takes one into a less rural scene, a busy road (the St Denis-Geneva route), large development schemes and the feeling of a busy and thriving community. A different and more impressive backcloth is provided by the Jura range of mountains curving away towards Strasburg with heavy wooded slopes and patches of snow on the higher peaks still visible. What of CERN I itself? This wedge shaped piece of land is on the whole crammed with buildings of many types, the only spacious area being at the Geneva end where the large building complex housing the ain Auditorium, Council Chamber, Restaurant No. 1, Public Information Office etc is partly surrounded by extensive lawns, trees and shrubs.

The layout, space and services provided in this building complex is very impressive but naturally the Public Information Office was of great interest to me and I have to say that I was rather envious of the services provided by this section. It soon becomes obvious that here is a set up geared to the information requirements of a 12 nation laboratory with, if I remember correctly, something like 1000 visitors per month. It is also the home of the CERN COURIER with a world wide distribution approaching 11000 copies per issue. Visitors however welcome can cause problems, how has CERN dealt with this? Just three illustrations; the main control room can be viewed from a glassed in area, a large glassed in viewing balcony overlooking the impressive new main computer hall, and finally the water tower situated on the highest point of the Meyrin site. Here a simple glassed in gallery has been built (no - one does not climb endless steps, there is a lift) giving spendid views of the surrounding countryside. Large photographs positioned round the gallery help to identify various points of interest. The path of the SPS with its 7km circumference, although little can be seen above ground takes on a new perspective. The average depth of the tunnel being bored is 40 metres below the surface and it was interesting to trace its path as it passed under fields, woods etc.

Magnet components (Bending Magnets) are now arriving in a steady stream and assembly testing is going ahead very well. Quadrupoles arrive completely assembled so they only need mechanical and magnetic testing. The November 1973 issue of the CERN COURIER gives an interesting account of the bending magnet assembly/testing procedure. At the time of my visit over 150 bending magnets and some 40 quadrupoles were ready. All this was being carried out in the huge assembly hall at CERN II which is situated in very pleasant countryside. One hears amusing stories about Customs, CERN II is mainly in France as is the nothern end of CERN I.

No. 1 Restaurant at CERN I is as I had so often heard, excellent, the presentation of the food is stimulating to the appetite and the steaks are good. The Main Auditorium, seating about 300, is a most attractive hall and I spent an interesting time with M Colombet being shown round both this and the Council Chamber suite and inspecting all the audio/visual aids. Later, attending a lecture given by Rod Cool of NAL I was interested to discover that the Rutherford Laboratory Lecture Theatre is far superior for speech reproduction. Nevertheless it is a fine hall and I understand excellent for music!

There was plenty of evidence still around of the highly successful Technology Exhibition and Conference and I hope to receive a full set of notes before too long. Two long days can at best only give a fleeting impression, nevertheless by using ones eyes and talking to a number of people one is left with a feeling of the high standard of excellence achieved in many fields, a sense of achievement and pride, also, perhaps, a certain feeling and I will say no more than that, about NAL's success to date.