



Rutherford  
Laboratory

COMMON/CSCAL/IBM, NERR, NCH, NGAP, ISCAN, NBR, NGR, NSCAN, NRC  
LIYSEL, IYSEU, IYMAX, NTRACK, 7-21 October 1974  
2NBEGIN, NTK, ATRY, NMISS, NSSR, NTL, MAX, MIN, FIRST, NEND, JTR  
COMMON/CFID/MFX(20,3), MFY(20,3), NFDX(10,3), NFX(3), NFO(3)  
JTAB(2,20,3), NX(100,4), NY(100,4), XN(2), YN(8), I  
R IDY(100,2), JDX(4), JDY(4), IHS(4), IGV(2), IUN(2)  
S NCF(16), IFS, NFS, FX, FY, JK, PIC, KPIC, NCUANT, NBIN, I  
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bulletin 20

## TRIUMF IN CANADA

In this introduction it seems appropriate to quote from the foreword to the last TRIUMF Annual Report - "TRIUMF continues to be watched across Canada and the world, both as a major new facility in nuclear science and as a co-operative project bridging several universities and several disciplines". Anytime now we should be getting news of the first run, this will be of special interest to the Laboratory as one of the first experiments to be mounted is the 'Basque' (see Bulletins 12, 13 & 19). Ron Wimblett, on his return recently from a 13-months stay in Vancouver, promised an article for the Bulletin. Here it is.

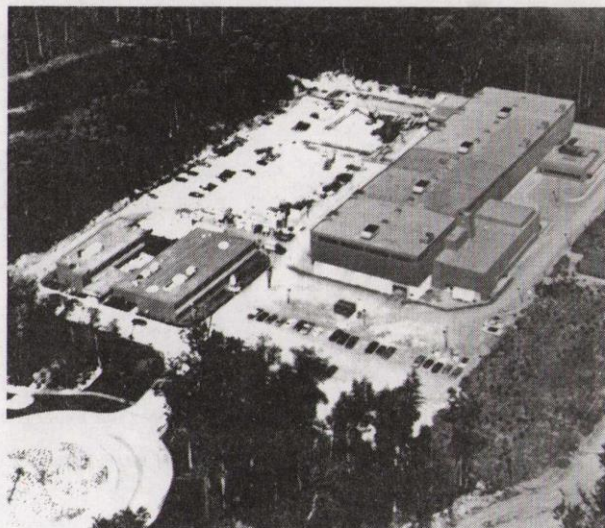
Is Triumf spelled wrongly? No, the name Triumf is a word assembly representing Tri-three, Universities, Meson, Facility and is the name of the Cyclotron complex nearing completion in Vancouver, British Columbia. Although the project originally involved three Universities, the four currently involved are University of British Columbia, University of Victoria, University of Alberta and Simon Fraser University.

Triumf Cyclotron is a 500 MeV accelerator, designed to provide precise particle beams for medical and nuclear research. In layman's terms, a cyclotron is a nuclear particle accelerator of circular shape. Charged particles are injected at the centre and are induced by two large D shaped magnets to follow a spiral path outwards from the centre. The particles receive energy increases during the spiral orbit and when traversing their maximum circular path are extracted to do useful work in the experimental halls.

The site of Triumf is on a clearing of a forest on the campus of U.B.C., approx. 1½ mile distant from the main University buildings. It was sited in close proximity to the University to take advantage of existing transport, stores and other administration facilities.

Vancouver, with a population of 1.1 million, is a clean pleasant modern city, positioned in a beautiful setting with snow peaked mountains to the north and bounded by the Pacific ocean to the west. The climate is similar to that of Cornwall with longer summers and rainier winters. The warmth, friendliness and absence of formality of the community is really quite infectious. It is difficult to imagine that a little over 100 years ago Vancouver was only a little Red Indian settlement. Now, in addition to the hustle and bustle of the city with its multi storey department stores, theatres, art galleries and museums, there is a modern University within which Triumf will soon be contributing in the forefront of nuclear physics research.

During the 13 months I spent at Triumf, I was responsible for the management, recruitment and



training of a team capable of designing, manufacturing and operating closed cycle refrigerated hydrogen target systems. Recently Alan Bishop left for Triumf to join this team. I hope he enjoys the beauty of British Columbia, in particular Vancouver; Vancouver Island and the Rockies as much as my family and I did.

The S.R.C funded Basque experiment, under the leadership of Professor Bugg, is one of the first beam lines to be mounted in the Triumf Experimental Halls and I know that they anxiously await the first particle beam from the cyclotron.

The completion of Triumf will be the culmination of many years of design work and the solution of a large number of complex technical problems, not the least of which was the painstaking effort over many months, to achieve the difficult magnet field parameters. The completion of the project has not been made easier by the shortage of both light and heavy engineering industries within the province, low financial grants and the organisational problems arising from multi-University involvement. However the spirit of enthusiasm to succeed has so far overcome all obstacles and setbacks.

Within the next few weeks we expect news of Triumf's first accelerated beam; this will be their real 'Triumf'. We wish them success with the first major Canadian cyclotron.

### BIOLOGICAL STUDIES AT THE LABORATORY

The treatment of tumours by radiation (gamma rays or electron beams) is known to most of our readers. Beams

of neutrons and protons are now being used in clinical trials in a number of places. Further clinical trials will soon be possible using negative pi-mesons ( $\pi^-$ , hereafter referred to as pions) at the new pion factories, following pioneering biological studies at Berkeley, CERN and the Rutherford Laboratory. In the following article by Doug Reading, the reasons why pions looked promising for therapy are discussed.

The  $\pi$  beam line, situated in Hall 3 is used to investigate the biological effects of stopping pions and the

underlying physical processes. These particles are easily produced if any atomic nucleus is hit hard enough by another particle. Their mass is nearly 300 times that of an electron, about a seventh that of a proton. Being much heavier than the electrons in an absorber they lose energy gradually, ionizing the material more and more as they slow down, until they stop quite close to where other pions of similar initial energy stop. This contrasts with gamma rays which interact mostly near the surface, and electrons which do not stop close together but spread out in depth.

The fact that pions cause the greatest ionization at a controlled depth is therefore advantageous to a radio-therapist trying to kill a cancer without excessively

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## INTERNAL EVENTS

### ATTENDANCE AT LECTURES

#### NIMROD LECTURE SERIES

Monday 7 October at 11.30  
Lecture Theatre

Punctuality is slipping; it is only courteous to our invited speakers for the audience to be in their seats by the stated time.

High Energy Elastic Scattering

*Dr R J N Phillips/Rutherford Laboratory*

#### TRADE DEMONSTRATION

Tuesday 8 October  
10.00 - 16.30  
Conference Room, Building R12

Chessell Ltd. produce a wide range of chart recorders offering some unique features. Instruments being demonstrated include: Micrograph Recorder - ultra high sensitivity (down to 1 microvolt per cm); Dial-A-Span - three channels each offering 450 Span sensitivities and 1999 Datum Shifts per span; Model 301 - Three channel unit of modular construction using either ink or electric writing system; a number of other instruments including Flatbed Recorders, Digital Integrators, Channel Selectors & Event Recorders.

#### HEP SEMINAR

Wednesday 9 October at 11.00  
Lecture Theatre

Reggeon Calculus Approach to High Energy Hadronic Scattering in Nuclei

*E Lehnan/Daresbury Laboratory*

#### SEMINAR IN COMPUTING

Friday 11 October at 11.00  
Conference Room, Building R12

High Level Network Protocols - *C Adams/Rutherford Laboratory*

Various network protocols that handle file transfer, RJE and terminal traffic will be discussed. The two networks that the I95 will be connected to will be used to provide examples, namely ARPA and EPSS.

#### NIMROD LECTURE SERIES

Monday 14 October at 11.30  
Lecture Theatre

$\bar{p}p$  Formation Experiments

*Dr A Astbury/Rutherford Laboratory*

#### RUTHERFORD LABORATORY LECTURE

Tuesday 15 October at 15.15  
Lecture Theatre

The R and D Dilemma

*Dr I Maddock/Chief Scientist, DTI (see news section for details)*

#### HEP SEMINAR

Wed 16 October 11.00 Lect Theatre

Details to be announced - see small notice boards

## EXTERNAL EVENTS

#### DARESBUURY LECTURE SERIES - 14.00hrs

8 Oct: *R J N Phillips/RL* - High Energy Elastic Scattering  
15 Oct: *S Yasumi/Tokyo* - Physics at the Tokyo Electron Synchrotron

#### THEORETICAL PHYSICS SEMINAR, MANCHESTER - 14.00hrs

9 Oct: *Prof R H Dalitz* - Baryon Spectroscopy & the Quark Model

#### COMPUTER SEMINARS AT DARESBUURY - 14.30hrs

9 Oct: *K V Roberts/Culham* - The Design & Construction of Large Physics Codes  
16 Oct: *C W Trowbridge/RL* - Magnet Design - the use of the Interactive Graphics Program GFUN

#### THEORETICAL & HEP SEMINARS, SOTON - 14.30hrs

11 Oct: *Dr A J G Hey* - Report on XVII Int Conf on HEP  
18 Oct: *Dr I G Halliday/Imp Coll* - The Field Theory of Reggeons

#### NP DIV SEMINAR, CONF RM, H8 AERE - 15.30hrs

17 Oct: *Dr D Swift-Hooke/CEGB* - Physics at Marchwood

## NIMROD SCHEDULE

CYCLE 9

1.10.74 - 22.10.74

SCHEDULE AS FOR CYCLE 8, PLEASE REFER TO BULLETINS 18 OR 19

#### RUTHERFORD LABORATORY BULLETIN

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Deadline  
for  
Insertions

GENERAL & SOCIAL NEWS

Tuesday 1600

INTERNAL & EXTERNAL EVENTS

Wednesday 1200

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damaging other tissue. Protons and other 'heavy' charged particles share this advantage. In fact, stopped protons are more localized as they scatter less as they stop, and the ratio of energy deposited (dose) deep into that at the surface would be greater than for pions were it not for the fact that pions react violently with a nucleus when stopped. The pion mass is converted to energy and given to the resulting nuclear fragments. Such nuclear fragments as carry a charge, surrender their energy to the nearby material along heavily ionized tracks. The result is that pions and protons have similar tumour to overlying tissue dose ratios. However, when the 'tumour dose' has a component caused by nuclear fragments, the biological effect per unit dose is greater, thus the result is as if the tumour dose were higher.

If tissue is deprived of oxygen it is found that it becomes radio-resistant, and as a cancer grows destroying the blood vessels, it becomes radio-resistant. This is due to reduction of oxygen containing free radicals that the ionization can produce which in turn attack the living material. However, heavily ionizing nuclear fragments as from pions, do so much damage locally that this radio-resistance may be overcome.

It must not be thought that these limitations of the conventional therapeutic radiations are not being tackled in other ways. Tumours are given a larger dose by irradiations from several directions. The oxygen effect is reduced because the radiation is given over a few weeks allowing the oxygen supply to return as the tumour shrinks. Protons, neutrons which when they react produce heavily ionized particles, and heavy ions (such as stripped nitrogen atoms) are also being considered for radiotherapy and each has its advantages.

During biological runs in Cycle 7, we achieved in all a steady absorbed dose of 160 rads/hour for long periods ( $\sim 3 \times 10^7 \pi$ /burst). Peak doses of 3 rads/min were recorded, twice that obtained last year. For therapy  $\sim 10$  rads/min would be needed. However before full scale preclinical trials, we need not only the five fold increase in dose expected using the new injector but also a new beam line with six times the acceptance because the region over which the pion stops must also be increased in a controlled manner to the volume of a tumour. We have a proposal before the MRC to cover the major cost. One experiment, continued in Cycle 7, was to expose young mice so that by observing the future incidence of cataracts we may assess the tolerable dose to the eyes of patients. The second experiment was to expose cultured cancer cells to measure the damage loss of reproductive capacity profile as a function of penetration depth for various doses, to confirm the predicted high level of damage deep in. A third series of experiments consists of exposing human white blood cells and observing chromosome damage, again to confirm predicted effects of the stopping pions.

**FILM BADGE NOTICE** Period II commences Monday 7 October. Colour Strip - BLUE for 8y films and neutron packs. Please change your dosimeters promptly and return all old ones. Six monthly TLD change for people with surnames commencing O P Q R.

**ACKNOWLEDGEMENT** Mrs Fielding and her son wish to express their thanks for the help and sympathy extended to them in their recent bereavement, and for the lovely floral tributes received from Bill's friends and colleagues.

#### RUTHERFORD LABORATORY LECTURE SERIES

The 1974-75 of lectures in this wide-ranging series opens with a talk by Dr Ieuan Maddock, CB, OBE, DSc, C.ENG, F.INSTP, F.IERE, F.IEF, FRs.

Dr Maddock has held the post of Chief Scientist at the Department of Trade and Industry since 1971 and he is also a Member of the Science Research Council. His interests are very wide including electronics, optics, mechanical engineering, electrical power, process plant, etc., and as well as a Fellow of a number of Institutes, he is active in a number of fields as a Member of the BBC Science Consultative Group, National Committee for Space Research, Television Advisory Committee, Court of Granfield Institute of Technology and amongst past positions and much nearer home, Assistant Director AWRE. It is hardly surprising that 'Recreational Activities' are omitted from his entry in 'Who's Who'. Dr Maddock has kindly provided the following summary for his talk which is entitled, 'The R and D Dilemma'.

*The UK has been a large spender on R and D for several decades, yet this has failed to reflect itself in economic growth. Whereas it is possible to point to brilliant technological achievements in many fields, other countries with only modest R and D expenditure and less glamorous products have enjoyed greater success in the world's markets. This poses a dilemma! Has the UK over-emphasised the role of R and D? Has it spent its money on the right things, in the right places and in the right way? Has there been a mismatch between the ability to create new concepts and designs and the capacity to convert these into economic benefit? These factors will be discussed with the aid of illustrations and the need to involve the customers' influence at an early stage will be developed. This leads to the creation of the "proxy customer" to cover the situation where a single coherent customer does not exist (in contrast to the case of the army, navy, air force, etc.) and where the benefits of the R and D are broadcast throughout a large number of people or institutions. The DTI newly-formed Requirements Boards will be described and their method of operation discussed.*

#### ANOTHER LIBRARY NOTICE

You forgot, didn't you! The Library is closed as it is moving from R20 to R61. It will reopen on Wednesday, 9 October.

#### OVERSEAS VISITS

Dr J D Lawson, to Switzerland, 4-5 Oct to attend dedication ceremony of SIN cyclotron at Villigen.  
Dr N H Lipman, to Germany, 6-9 Oct, to attend Meeting on Neutrino Physics.  
Mr R Morgan, to CERN, 6-9 Oct, to appraise ISR equipment for return to UK.  
Mr R J Stanhope & Mr C N Uden, to CERN, 6-9 Oct, to attend 'Hyperon 300' Eng Grp meeting and meet CERN Safety Officers.  
Dr C J S Damerell, to CERN, 6-11 Oct, for work on S120 and P7 experiments.  
Dr A Astbury, to CERN, 7-9 Oct, to hand over Visiting Scientists Committee duties to H Sons.  
Dr G Manning & Mr P H Sharp, to CERN, 7-9 Oct, for discussions.  
Dr L C W Hobbs & Dr P R Williams, to Paris, 8-10 Oct, for discussions on High Energy Lasers, Dr Hobbs will also visit ILL on 11/9.  
The Director, to CERN, 10-11 Oct, to attend Restricted ECFA Meeting.



## SOCIAL NEWS



Dr G Manning studying the parting gift which, on behalf of her many friends & colleagues, he had just presented to Mary Didrickson, who as can be seen in the photograph above is looking very pleased. Mary left at the end of September having worked at the Lab for - well let's just say that NIRNS had not been replaced by SRC when, as Geoff said, 'she joined the Lab as an innocent 18 year old'. She has taken up a post at Carmel College. A letter has arrived from Mary expressing her thanks to everyone, in particular those she was unable to meet, continuing "My stay at Rutherford (I won't say just how long) has been a happy one and although I am naturally looking forward to my new venture, I shall miss life at the Lab and all my many friends there very much. My sewing machine will always remind me of you all."

**1974 RUTHERFORD ANGLING CHAMPIONSHIP** This year's championship will be fished on Saturday 26 October at Clifton Hampden. For further details contact C Halliday, ext 374, A R Hodgies, ext 445, or P Craske, ext 232. Names to be in by 21 October.

**1974 CIVIL SERVICE SEA ANGLING CHAMPIONSHIP** Anyone interested in this (Southern Region) championship, an individual and team event, to be fished at Southampton on Sunday 17 November is asked to contact P Craske, ext 232.

**1974 CIVIL SERVICE CHESS CHAMPIONSHIP** Anyone wishing to enter for this (Southern Region) championship, a team event, to be held at Basingstoke on Sunday 24 November is asked to contact P Craske, ext 232.

**CHRISTIAN FELLOWSHIP** Not many of us have the opportunity (or even desire) to motor across the Sahara Desert. Two persons who are about to set out on such a journey are visiting the Laboratory on Friday 11 October at 12.30, R12 Conference Room. They are medical missionaries, at present residing in Chilton, who have spent many years working in Tanzania. A church group recently presented them with a new Landrover and they are hoping to sail to Tangier and then use it to travel across the Sahara. Everyone is welcome to come and hear what they hope to achieve and also of their 'adventures' in the past.

Many people find the Bible a puzzling book and wonder what it seeks to teach. Is it merely a masterly anthology? or mythology? Or is it a coherent and minutely harmonized whole? The Rutherford Laboratory Christian Fellowship is organizing a programme of meetings over the next ten months at which various experts have been invited to speak on the "Bible and its Revelation of God". It is hoped that the series will be characterised by its helpfulness and depth of treatment of the subject.

Dr John Savage of MRC has been invited to speak on the subject, "How God Spoke to Early Man", on 18 October, and to follow up in leading a discussion on 25 October. The meetings will be held in their usual venue - Conference Room, R12 at 12.35.

**SOCCER** R25 failed in their bid to maintain their 100% record when they were beaten for the first time on Wednesday 25 September by Transport. Eddie Smith put Transport ahead in the 12th minute with a close range shot. Dave Matthews had a chance shortly afterwards but Transport keeper Ray Smith, who was in excellent form, pulled off a fine save. The game continued to flow, first one way and then the other with neither side holding the balance for long. Transport increased their lead shortly after the start of the second half when Eddie Scurr whipped in a real pile driver which swept into the roof of the net. Then with the game almost in its final minute, Matthews pulled one back when Smith failed to hold the greasy ball.

Group 1		RESULTS	Group 2	
Taylors 3,	Atlas 0		Transport 2,	R25 1
Taylors 0,	C & A 2		Transport 3,	Nomads 1
C & A 4,	Atlas 1			
R9 0,	C & A 5			
		TABLES		
	P W D L F A Pts		P W D L F A Pts	
C & A	5 4 0 1 14 8 8	R25	4 3 0 1 11 6 6	
Taylors	6 3 1 2 11 9 7	Transport	4 2 1 1 7 6 5	
R9	6 2 2 2 14 14 6	Nomads	4 0 1 3 3 8 1	
Atlas	5 0 1 4 8 17 1			

It is hoped to play the Final, C & A v R25, on 10 Oct, KO 12.40.

**CHALLENGE DARTS MATCH** The Electrical Design Office (R2) easily held off the challenge of the Mechanical Design Offices (R2) to win 3-0.

**REC. SOC. SUPPER DANCE** After a year's break (due to unforeseen difficulties) the Rec. Soc. Dances are back, the first to be held will be on 18 October, 8 till 1, dancing to BURLESQUE. Tickets, 80p, from P Craske, R2, F Cooke, R9, Mrs V Goodwin, R1, G Pullinger, R1 and D Evans, R36.