RUTHERFORD

Bulletin 11

6 - 27 June 1977

Inauguration Day Programme

An important milestone will be reached on Monday 20 June when for the second time in the comparatively short life time of the Rutherford Laboratory, a Secretary of State will perform the opening ceremony for a major scientific facility, the first being the inauguration of Nimrod on Friday, 24 April, 1964.

Who present on that occasion will (or can) ever forget a particular movement from Elgar's Enigma Variations which was played over the PA system, literally from dawn to dusk.

On this occasion, we welcome the present Secretary of State for Education and Science, the Right Honourable Mrs Shirley Williams, MP, to the Laboratory to officially open the SRC's Central Laser Facility.

The arrangements for the day will affect most members of staff as these range from the use (or rather non-use) of the Restaurant to car parking restrictions and these are given below together with details of the Secretary of State's visit and the inauguration ceremony.

The Chairman of the SRC, Sir Sam Edwards, will meet Mrs Shirley Williams at Didcot station and accompany her to the Rutherford Laboratory, arriving at 1045.

She will be received by the Director, Dr G H Stafford, and escorted to the Director's Conference Room where, over coffee, she will be introduced to members of the Primary Party and given a brief explanation of the laser facility.

Owing to space limitations in the Laser Laboratory, numbers in the Primary Party will be kept to a minimum. At the time of going to press, the party will consist of the Secretary of State, Dr and Mrs G H Stafford, Sir Sam Edwards, Dr A F Gibson, Dr P R Williams and Mr W O Ulrich, Deputy Secretary, DES.

An hour has been allocated (1120-1220) for the party to tour the Laser Laboratory after which they will walk to the R22 Coffee Lounge where (from 1230-1245) the Secretary of State will meet Staff Side and Trade Union representatives.

The period, 1245-1430 will cover lunch, speeches and the opening ceremony. Ten minutes has been allowed for the Secretary of State to meet the Press and Mrs Williams will depart for Didcot at 1440.

Many eminent scientists have been invited to the inauguration lunch including representatives of committees and working parties, members of the RL Establishment Committee, the Science Board, the SRC Directorate, other SRC Establishments, Dr L E J Roberts - Director of Harwell and Prof Sir Herman Bondi. From industry, Dr G Bret, Head of Quantel SA, the French firm who supplied the 100 gigawatt driven rod laser system and Dr L Reed, Vice President, ILC Technology INC., USA, suppliers of the main output disc amplifiers. Laboratory staff invited include the Division Heads, all members of the Laser Division plus members of Nimrod Division industrial staff who were involved with the setting up of the facility. Also invited, Staff Side and Trade Union representatives, journalists from local press, press association, Radio Oxford, Central Office of Information (Reading) and from selected technical journals.

Visitors to the Laboratory will be able to visit the Laser Centre during the afternoon.

The R22 Restaurant, Coffee Lounge and Lecture Theatre will be closed to members of staff, but a prepackaged aircraft type lunch will be available in a marquee adjacent to R22. Details of lunch arrangements are given at bottom of page.

The Lecture Theatre and the R22 Coffee Lounge only will be open again as from 1300 hours to enable staff to hear a sound relay from the Restaurant of the speeches and the inauguration ceremony. In addition, the colour TV relay from the Laser Centre, as seen by guests in the Restaurant, will be shown in the Lecture Theatre on a big screen (6' x 4'). The R1 and R20 Car Parks will not be available for normal use.

Press Visit

A press review has been arranged for Friday 17 June. The only restriction affecting staff will be the closure of R22 Coffee Lounge, therefore coffee will be served in the Restaurant. The visit is timed to last from 1045-1345.

Lunch Arrangements for 20 June

The article about the Laser Inauguration refers to the fact that the Restaurant will not be available for usual customers on that day, instead a meal will be provided in a marquee.

This will be a pre-packaged meal of cold meat, salad, cold sweet, cheese and biscuits and will be available at a fixed price of 40 pence. To determine as accurately as possible, how many meals will be required, it will be necessary to sell tickets in advance. They will be available in the Restaurant and the R1 Coffee Lounge from Friday, 3 June until Wednesday, 15 June.

Coffee, Tea, soft drinks and beer will be available for sale in the marquee at normal prices.

The Heart of the Matter

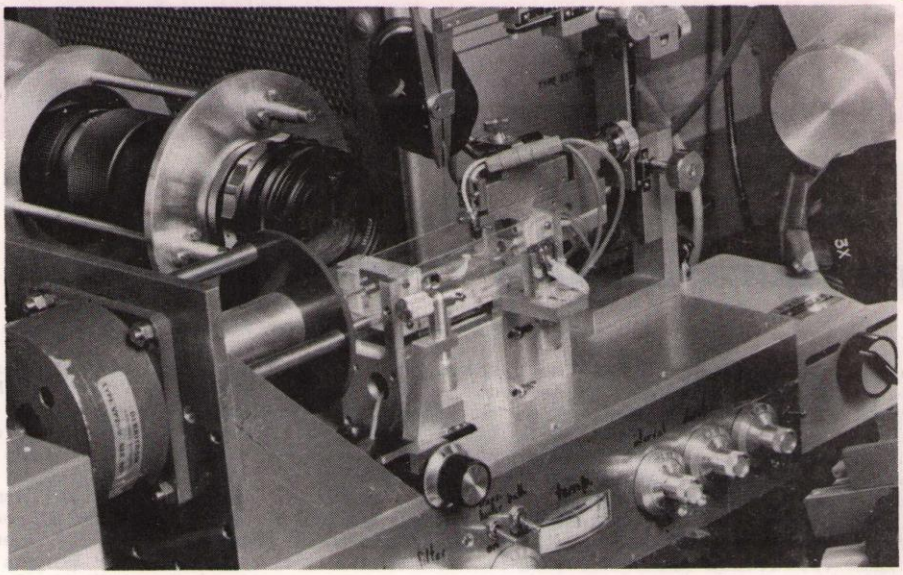

Photo: The heart of the instrument showing, in centre, the Nutrient bath containing muscle specimen; to left of bath - displacement driver; upper left - TV optics; above bath - micro-manipulator for inserting pins.

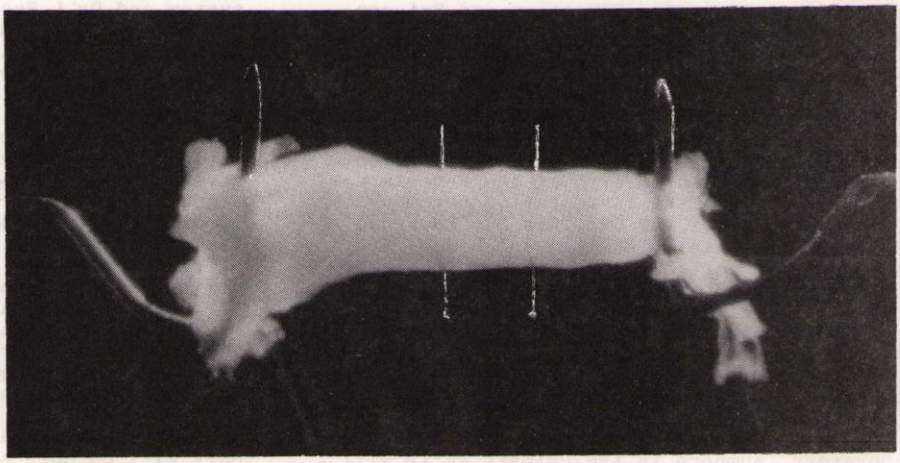

Photo: Mounted specimen of rat heart muscle: in this magnified picture the 20 micron pins, 0.5 mm apart, are clearly shown in the central region. The mounting hooks connect, on the left, to the linear displacement driver and on the right, to the force transducer.

A new method of measuring length changes during mechanical testing of heart muscle specimens has been developed jointly by the Rutherford Laboratory and the Department of Engineering Science, Oxford.

The really vital part of this instrument, a high definition TV camera with its associated electronics, similar to a Rutherford Lab design used on the Omega Spectrometer at CERN, is another significant spin-off from instrumentation techniques developed for use in High Energy Physics Research. Following the publication of an article on the technique in the Journal of Physiology, interest has been shown from a number of universities and medical centres.

Before describing the instrument and its application to cardiac muscle, it may help to clarify the functional differences between cardiac muscle and the more familiar skeletal muscle. Skeletal muscle (eg biceps) require an external stimulous to initiate contraction and has to be capable of reacting very quickly and holding a steady load. Cardiac muscle on the other hand, can contract spontaneously, although in the interests of pumping blood, the contraction at different parts of the heart is synchronized by the 'pace maker'. Cardiac muscle does not need to react very quickly or maintain a steady contraction; it is however advisable that it works continuously!

Drugs and the heart

An understanding of how various drugs influence the behaviour of the heart is enhanced by measuring their effect on the mechanical behaviour of small cardiac muscle specimens (usually intact papillary muscle which protrude from the walls of the ventricles and connected, via tendons, to two of the heart valves to prevent them inverting when ventricular pressure rises).

These measurements (standard frequency-response and transient-response) are complicated by two rather unusual aspects of cardiac muscle. First, the ratio of length to diameter in the specimens (typically 3mm long and 0.3mm diameter in rat muscle under study) is not sufficient to avoid significant end effects due to cell damage where the muscle is attached, at one end to a force transducer and at the other, to a displacement driver. Second, the measurement must be made while the muscle is actively developing tension (about 100 msec) following an electrical stimulus (as it does for example, when the heart squeezes blood out of the ventricles).

The problem then was to measure the distance between two points in the central undamaged part of the muscle, without mechanical connections, with the muscle in motion. Moreover the instrument had to be capable of responding fast enough to permit that length to be held under servo control as the muscle developed tension and attempted to contract or shorten. All this with the muscle specimen immersed in a bath of nutrient solution to keep it alive for a few hours.

Paths to Success

The method developed employs a TV camera to monitor the displacement of two 20μm pins (20 microns = less than one thou) inserted vertically through the central section of the muscle specimen about 0.5mm apart. The operating

cle of the TV Camera system is as follows: Initially start pulse is produced which can be used as a master reference. (For example, to initialise an electrical impulse to the muscle section). At the same time, the pins in the muscle are illuminated for 10μsec, and their image is magnified and focussed on to the TV camera tube face where it is stored. Also at this time the scanning beam of the camera tube is deflected across the tube face along a path close to the top edge of the muscle.

As the beam sweeps across the face of the tube it passes the position where the image of the pins has fallen when they were illuminated. The beam performs two functions as it passes the stored image; it will convert it into an electrical signal and at the same time remove nearly all the image that it has scanned. After 20μsec this latter cycle is repeated along a new path just below the section of muscle. This second scan leaves the tube ready to receive another image or picture just 240μsec after the first one, and so the whole process is repeated.

The video signal consisting of pulses corresponding to the pins positions is then processed, producing two very narrow (70 nanosecond) pulses per scan. The first pulse is used to start an 80 MHz clock, the second to stop it. The number of clock pulses that have occurred during this time are counted and stored. When the number of clock pulses along the second (and lower) scan line have been counted, then the average of both upper and lower counts represents the displacement along the axis of the muscle. With the muscle stationary, a typical accuracy of 1μm is achieved.

The resultant digital count is then converted to an analogue signal (lets say 1000 counts equals 10 volts), and it is this analogue signal that is used to control the position of the servo motor and keep the pin displacement constant while the muscle develops tension and attempts to shorten following an electrical impulse. For example, in response testing the mean displacement of the pins is held constant while sinusoidal length changes at frequencies of up to 750 cycles are superimposed and the resulting force measured by the transducer. With a camera scan time of 100μsec per line, a maximum sampling rate of 7.4 KHz is possible.

Summarizing: Mechanical tests on isolated cardiac muscle specimens are conducted in order to quantify the

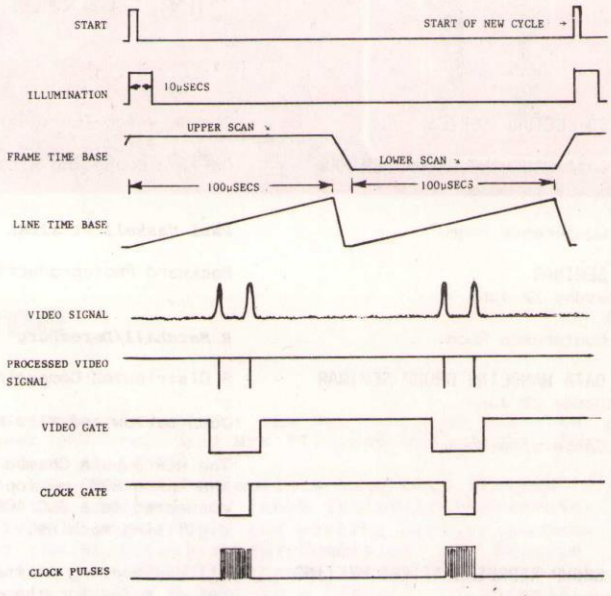

Diagram: Camera and signal waveforms

behaviour of the heart under various conditions, such as during the administration of cardiac drugs. The instrument described here enables these tests to be conducted with considerably more accuracy then before by monitoring the displacement of two small pins inserted in a uniform undamaged part of the muscle. The instrument is now being used at the Department of Engineering Science in Oxford.

The Editor wishes to thank Bob Barnard and Bob English, Rutherford Lab, and Peter Hunter and John Hastings, Dept of Eng. Sci, Oxford, who jointly developed the instrument described, for considerable assistance in producing this article. Acknowledge is also given to the Dept of Eng. Sci for the use of photographs.

A PEDESTRIAN AFFAIR The Harwell Joint Site Environment Committee, successor to the former Road Safety Committee has agreed to the provision of a modified pedestrian crossing (without beacons) to join the path from the Rutherford Laboratory to the centre island at the Bus Park. From the safety angle, pedestrians are advised to use this single crossing point.

MAIL ADRIFT A large envelope containing technical information and a letter has been received from Dynamic Logic Ltd. This has been sent at the telephone request of a Mr D Adamson, who can collect envelope and contents from the Editor, Room 42, R20.

OVERSEAS VISITS Dr D R Quarrie, to Hamburg, 5-17 June; computing for PETRA experiment and group meeting.
Mr C J E McDonald, to CERN, 8-17 June, for administration discussion.
Dr F E Close, to the USA, 9 June-17 September; collaboration with groups at Argonne and SLAC.
Dr R G Roberts and Dr M J Counihan, to Kayserberg France, 12-17 June, to attend VIII International Symposium on Multiparticle Dynamics.
Dr T R M Edwards, to Eindhovon, Netherlands, 19-26 June, to present paper at the IFAC/IFIF Workshop on Real Time Programming.
Mr R A Lawes, to Paris, 20-24 June, to attend International Conference on Microlithography.

FILM BADGE NOTICE It is Period 6. Colour Strip - ORANGE for βγ films and neutron packs. Please change your films promptly and return ALL old ones. Period 7 commences Monday 13 June.

DATE FOR YOUR DIARY Sports Day, 13 July. Details in next issue of Bulletin including closing date for entries.

WEEK IN NORFOLK Val Goodwin still has a few seats left for the August Bank Holiday weekend for the tour of Norfolk including a visit to Sandringham Castle. Cost: £26 inclusive.

VISIT TO COMPTON WYNYATES AND SCOOPS - 6 JULY For details of this outing please contact Val Goodwin Ext 6256.

RUTHERFORD TABLE TENNIS CLUB The AGM will be held in R15 on Thursday, 23 June at 1230 hours. All members are invited to attend.

ANNUAL DARTS TOURNAMENT Names of teams and entry fees to be sent to A Forster, Building R6 by 1 July.

INTERNAL EVENTS

NIMROD LECTURE SERIES

Please watch TODAY notice boards for details of forthcoming lectures.

HEP DATA HANDLING GROUP SEMINAR
Wednesday 15 June
1330
R61 Conference Room

On-line Debugging Aids on the GEC-4080, PDP-11 and a Special Purpose Processor.

Paul Haskell et al/RL

HEP SEMINAR
Wednesday 22 June
1100
R61 Conference Room

Backward Photoproduction of Ω at 3-5 GeV (Observation of Background Peak and Dip)

R Marshall/Daresbury

HEP DATA HANDLING GROUP SEMINAR
Wednesday 22 June
1330
R61 Conference Room

A Distributed Computing System Using Microprocessors

John Barlow and Mike Walters

The HEP Bubble Chamber Group is constructing a set of microcomputers based on the Intel 8080 microprocessor and has linked them into a star network which is connected to a GEC 4080 computer. Each microporcessor is connected to a film digitising machine.

195 GROUP REPRESENTATIVES MEETING
Wednesday 29 June
All day (9.30 start)
Lecture Theatre

All day meeting of the 195 Computer Group Representatives. A programme and set of notes for the meeting will be distributed to Group Representatives shortly. Details of the programme will also be published in the next issue of the Bulletin.

EXTERNAL EVENTS

ELEMENTARY PARTICLE PHYSICS SEMINARS/NP LAB, OXF - 1430hrs

9 June: **Prof V Peterson/CERN, Hawaii - Neutrino induced D1-muon events in the FNAL 15ft bubble chamber with a two-plane external muon identifier.**

16 June: **Dr P Benz/DESY - Reactions 'proton + proton → proton + proton + meson' at ISR energies.**

ELEMENTARY PARTICLE THEORY SEMINARS/NP LAB, OXF - 1430hrs

16 June: **Dr P Higgs/Edinburgh - Spontaneous breaking of super symmetry.**

17 June: **Dr P Landshoff/DAMPT - Hadron structure and large P_T processes.**

THEORECTICAL PHYSICS SEMINARS/CLARENDON LAB, OXF - 1615hrs

9 June: **Dr T Lane/AERE - Laser-atom reactions to a nuclear physicist.**

NUCLEAR STRUCTURE SEMINAR/NP DEPT, OXF - 1430 hrs

13 June: **Dr I Wright/Manchester - Some s-d shell rotational states.**

COMPUTER APPLICATIONS SEMINARS/NP LECT. TH, OXF - 1630 hrs

9 June: **Prof L Fox/Oxf - How to get rubbish in numerical computing.**

16 June: **Dr J Rollett/Oxf - Function optimisation techniques.**

23 June: **Dr E J Williamson/Oxf - Computing in atmospheric physics.**

NUCL PHYS DIV COLLOQUIA/AERE, CONF. RM. H8 - 1530 hrs

16 June: **Drs F S Feates & B Rose - High level radioactive waste disposal and the Oklo phenomenon.**

23 June: **Mr C G Clayton - The work of the Industrial Physics Group.**

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Editor: H F NORRIS
Room 42 Building R20
Rutherford Laboratory
Chilton Didcot Oxon OX11 0QX
Abingdon (0235) 21900 Ext 484

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Supplement

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16 June 1977

Laser Inauguration - 20 June 1977

Last weeks bulletin explained the programme for the Inauguration Ceremony. This programme has had to be changed because Mrs Shirley Williams is unable to attend.

The Inauguration which was planned to take place in the Restaurant will now be carried out by Sir Sam Edwards at a small ceremony in the Laser Centre on Monday morning but this will not be televised to the Lecture Theatre.

The luncheon will be held as planned but the speech which the Secretary of State had intended to make will be delivered, on her behalf, by Mr W O Ulrich, Deputy Secretary responsible for Science at the Department of Education and Science.

This, and other speeches, will be relayed to the Lecture Theatre starting at approximately 2 pm. Any member of staff who wishes to go in will be be free to do so.

Laser Laboratories open to RL Staff

The Laser Laboratories will be open from 10 am to 12.30 on Tuesday, 21 June 1977 for any staff who wish to look around. The exhibits in the entrance hall of R1 will remain until 24 June 1977.