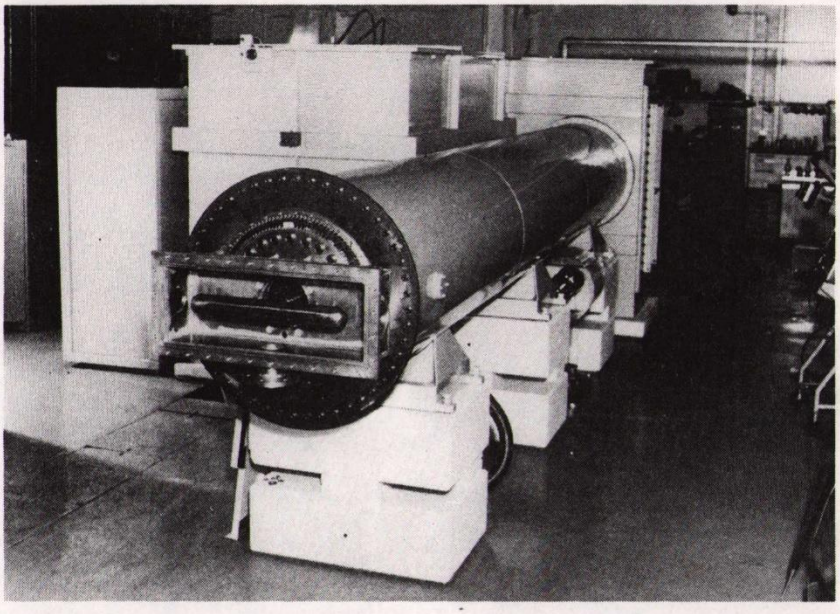
RUTHERFORD Bulletin 22
4-18 December 1978

Introducing ELF



View of ELF machine with its Charging Unit and Marx Generator tank in the background and the Blumlein supported on three pedestals. Connected to the front end of the Blumlein we see the cigar-shaped cathode which produces a high power pulsed electron beam, used to excite gases to produce intense laser light.

There is considerable world-wide interest in the development of new high power lasers operating in the visible wavelength region. During 1977 a gas laser development programme was initiated at the Rutherford Laboratory to evaluate the potential of new gas lasers. This programme required a high power, pulsed electron beam source to excite the gas mixtures - thereby obtaining laser action in them, and it was decided to design and build such a facility at the Rutherford Laboratory, to enable a team to acquire the expertise, essential for future gas laser projects. This machine is code-named ELF (Electron-beam-excited Laser Facility) and we bring you the news that its construction is now complete and ELF has just produced its first electron beam pulse.

The UK currently holds a highly respected position in the design and development of high-power pulsed electron beam generators, thanks to the pioneer work in this field by the high voltage research group at AWRE Aldermaston. The general design of Rutherford Laboratory's electron-beam machine was supplied by the AWRE group and the detailed design work was carried out by Rutherford Laboratory staff in close collaboration with AWRE. Most of the fabrication work was contracted out to local engineering companies.

A recent view of ELF is shown in the photograph. ELF is based on an oil-filled co-axial Blumlein which is pulse-charged by a Marx generator. The negative voltage from the Blumlein is switched onto an electron gun vacuum diode, thus producing a pulse of 1.5 MeV electrons of 50 nanoseconds duration. The initial design of the cathode provides a 60 kiloamp rectangular electron beam of dimensions 5cms x 50cms. The electron beam pulse is deposited in a laser test cell containing the gas mixture under study.

The component parts of ELF have been tested separately during the summer and then assembled for the final test. On Wednesday 15 November ELF produced its *first electron beam pulse* and the machine is now undergoing detailed tests to achieve all the design specifications quickly. The rapid success of the ELF construction project is a credit to the Laboratory staff involved and the close collaboration with AWRE.

ELF will be used by University and Laboratory scientists in their search for more efficient and new types of high power lasers. The initial experiments will concentrate on investigations of the recently discovered atomic selenium laser. However, ELF is designed to be suitable for excitation of a wide range of gases and thus the research programme is expected to develop into other areas in the coming months.

(We thank Fergus O'Neill for the information contained in this report.)

INTERNAL EVENTS

NIMROD LECTURE SERIES

Monday 11 December
1130 hrs
Lecture Theatre

Recent Theoretical Developments in Neutrino Physics.

Professor J Smith/CERN and Stony Brook

HEP SEMINARS

Wednesday 6 December
1100 hrs
R61 Conference Room

Calorimeter Triggers for Large p_T Events

Professor J C Polkinghorne/Cambridge.

Wednesday 13 December
1100 hrs
R61 Conference Room

$K^o_L P$ Interactions in the Energy Range 1.65 - 1.9 GeV.

P Watkins/Birmingham

THEORETICAL PHYSICS MEETING

Lecture Theatre

Tues. 19 December	**14.00 hrs**	**A Salam/Imperial & Trieste - Unification and Superunification.**
	16.00 hrs	**D H Perkins/Oxford - Lepton Scattering and QCD**
Wednesday 20 December	**09.45 hrs**	**C Sachrajda/CERN - Perturbative Applications of QCD**
	11.45 hrs	**R Devenish/DESY - e^+e^- Results from DESY.**
	14.15 hrs	**M K Gaillard/CERN - Heavy Quark Decays.**
	16.05 hrs	**D Gross/Princeton - Instanton Physics.**
Thursday 21 December	**09.45 hrs**	**D Olive/Imperial - Supersymmetric Solitons**
	11.45 hrs	**A Leggett/Sussex - Macroscopic Parity Violation.**
	14.15 hrs	**M Veltman/Utrecht - Weak Interactions at High Energy.**

RUTHERFORD LABORATORY CAROL SERVICE

Thursday 14 December
1240 hrs
Lecture Theatre

The Reverend Brian John of Wantage Baptist Church will lead the service which will be accompanied by John Hardaker at the Organ. An item by the Rutherford Hand Bell Ringers will give the service extra sparkle.

OVERSEAS VISITS

R P Hand to CERN 4-22 December to work on Hyperon expt WA42.
R W Newport, W Turner, A Edwards, A Thorp to CERN 4-6 December to attend meetings of European Hybrid Spectrometer.
C M Fisher to CERN 4-13 December to work on High Resolution Bubble Chamber.
P Sharp to CERN 4-7 December to work on Prop 20
R Croucher and J Summers to DESY 4-15 December to work on JADE installation.
H J Jones & R J Stanhope to DESY 4-8 December to work on JADE installation.
J D Lawson to VENICE 4-8 December to present paper.
C Batty to IKD Amsterdam 7-12 December for discussions and seminar.
R J N Phillips to Winsconsin 8-17 December for discussions.
J A Blisset & B T Payne to DESY 10-19 December to work on installation of TASSO.
P J Litchfield to CERN 12-15 December to work on RMS Expt.
J Hoskins & G Kilbee to DESY 13-21 December. Installation of CPC and Muon tube readout system.
L Phillips and K Miles to DESY 13-20 December. Installation work on JADE & TASSO

CHRISTIAN FELLOWSHIP

The meetings on Friday 8 Dec and 15 Dec. will be held as usual in the Conference Room on the top floor of R2. All are invited.
Dec.8th. In these days of seemingly unending industrial strife, what are the attitudes of Christians to work and employment. Do Christians strike? What influence do Christian Trade Unionists have? Ray Powell will lead a discussion on this topic.
Dec 15th. Dr John Savage, head of Cytogenetics at MRC will lead the meeting which will be on the theme of Christmas.

TRAINING

ANNUAL PRIZE OF THE BRITISH VACUUM COUNCIL

Entries are invited for the annual prize offered by the British Vacuum Council to a young scientific worker for the best submitted paper upon vacuum studies or any topic in which vacuum science or engineering is of major importance (for example thin films studies, surface science or vacuum metallurgy). Entrants for the prize must not have passed their 27th birthday on the last day for submission for entries (1 March 1979).

UNIVERSITY OF SALFORD
"Fundamentals of Vibration Isolation".
Friday 12 January 1979 - one day course.

Further details of the above items can be obtained from the TRAINING SECTION R20. Ext 6285/266.

OBITUARIES

We regret to announce the sudden death of Mr R T Daniel on Saturday 18 November at his home. He was aged 49. Bob Daniel joined the Rutherford Laboratory in 1961, coming to us from AERE after serving in the Royal Navy. He worked on the PLA until its closure and then transferred to Technology Division where he was engaged in the development of Superconducting Magnets. He was a highly valued member of a Team who will greatly miss him, as will all his friends and colleagues.
Our deepest sympathy is extended to his wife Ann and to his children, David, Pamela, Jacqueline and Christine.

We have also learned with sadness of the sudden death of Mr G N Venn on Friday 17 November at the age of 63. Norman Venn worked at the Rutherford Laboratory from 1961 until his retirement in 1976 at which time he was Head of Nimrod Division. He was always held in high esteem by his colleagues both in the Engineering profession and the Scientific community, and was known as a very loyal, conscientious, approachable, helpful colleague and friend. We extend our deepest sympathy to his family.

EXTERNAL EVENTS

THEO.PHYS.SEMINARS/CONF.RM. 8.9 AERE - 1400 hrs
5 Dec: **Dr W C Mackrodt/ICI - The Calculation of Point Defects in Alkaline - Earth Oxides.**

12 Dec: **Dr D W Bullett/Cambridge - The Renaissance of the Tight-Binding Method.**

PHYS. & GEOPHYS. COLLOQUIA/Rm G12 ROYAL FORT BRISTOL U. - 1700
11 Dec: **Dr G D W Smith/Oxford - Applications of Atom Probe Microanalysis.**

PHYSICS SEMINARS/BIRMINGHAM UNIV. - 1615 hrs.
8 Dec: **Prof. C Michael/Liverpool - QCD, High p_T and Dileptons.**

15 Dec: **Dr Websdale/Imperial College - Results on Dilepton Production from the Goliath Spectrometer.**

THEO.PHYS.SEMINARS/BRAGG.L.TH. MANCHESTER - 1615 hrs.
6 Dec: **Dr A F Gibson/RL - High Power Pulsed Lasers for Plasma Compression and (hopefully) Fusion.**

THEO.PHYS.SEMINAR/SCHUSTER LAB MANCHESTER - 1430 hrs
13 Dec: **Dr G Ross/Oxford - Scaling Predictions in QCD.**

THEO & HEP SEMINARS/L.TH.C. SOUTHAMPTON - 1430 hrs
8 Dec: **Prof M Scadron/Imperial and Arizona - Quark Masses**

THEORY GP SEMINARS/ CONF. RM.3. DARESBURY - 1400 hrs
11 Dec: **Dr B Buck/Oxford - Collective Variables for the Description of Rotational Motion in Many Particle Systems.**

12 Dec: **Dr B Buck - Rotational Spectra from One Particle Potential Model.**

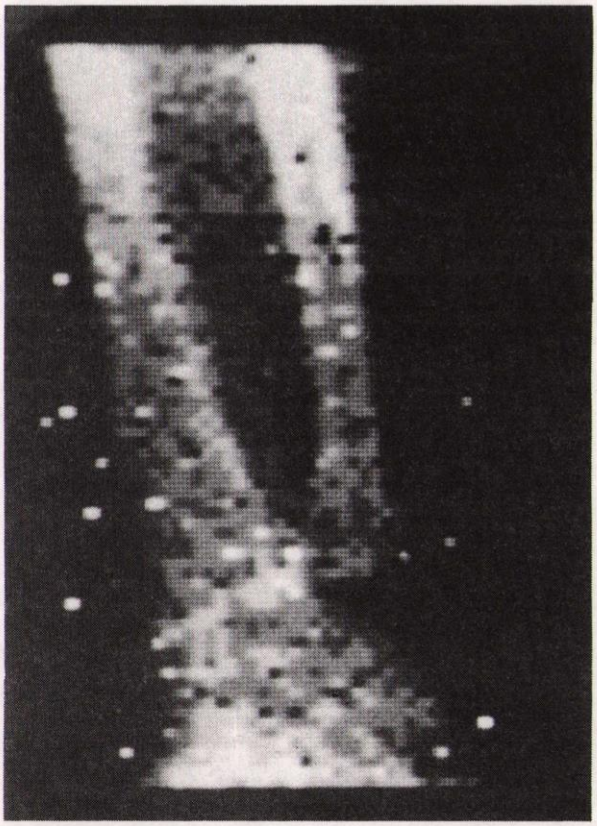
18 Dec: **Dr R Huby/Liverpool - Description of Scattering Amplitude by Humblet's Modified K-Matrix.**

ELEM.PART.PHYS.SEMINAR/QUEENS BLDG. WESTFIELD COL - 1400 hrs
6 Dec: **Dr G Shaw/Manchester - Shadowing Vector Mesons and Partons.**

PHYSICS COLLOQUIA/CLARENDON LAB OXFORD - 1615 hrs
8 Dec: **Prof L van Hove/CERN - The Status of High Energy Physics and the CERN Research Programme.**

THEO.PHYS.SEMINAR/QMC - 1615 hrs
11 Dec: **Dr I Drummond/Cambridge - Trace Anomalies.**

Chasing Osteoporosis



An x-ray image of a human wrist detected using a multi-wire proportional chamber. The development of this technique promises to be useful in the detection of loss of bone mass in patients.

Osteoporosis is a disease that occurs in females over menopausal age resulting in the loss of bone mass which gives rise to brittle bones and related conditions. The treatment appears to be the administering of oestrogen hormone, and pilot studies have shown some improvement when this hormone has been used.

However, it is the detection and monitoring of this condition which have proved to be difficult. How can you detect a bone mass loss of about 1% per year? It is not considered practical to remove a piece of the patient's bone every 3 months - it is not realistic to include such a test in periodic medical check-ups. For this reason x - ray methods have been used, since the x-rays are absorbed (or scattered) by matter and one can infer the bone mass by detecting the number of x-rays which penetrate the thickness of a limb. Tests have shown that this method is not entirely satisfactory, due to difficulties in locating the exact site of previous measurements. A reasonable radiation exposure can produce bone mass results with an accuracy of only about 7%.

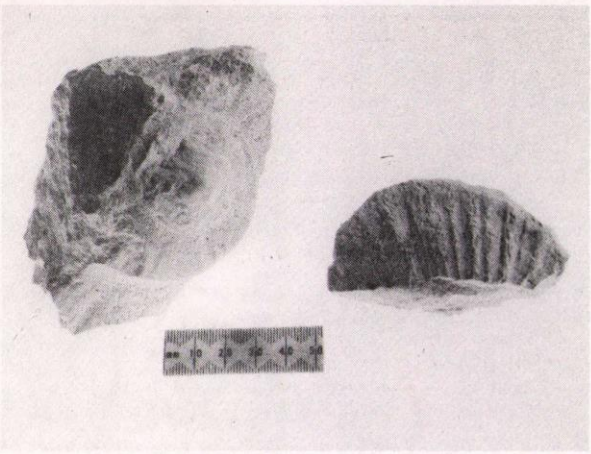
Staff at the Rutherford Laboratory have attempted to provide a solution to this problem using techniques developed in particle physics research. A multiwire proportional chamber has been re-developed for image monitoring from an x-ray source. The patient places a limb (the wrist for example) between the source and the chamber. The multiwire chamber detects the pattern of x-rays passing through the limb, recording the data into a computer. The photograph shows an x-ray image of Eddie Bateman's wrist displayed on a TV screen.

The computer program searches for the outline of the bones and compares the exact shape with the results taken 3 months earlier. This fitting technique promises to provide a bone mass comparison to within an accuracy of better than 1%. Repeated measurements improve on this accuracy.

A unit has been built and commissioned at the Rutherford Laboratory and has just been delivered to the Leeds General Infirmary. Further clinical trials will be performed during the coming year to establish the reliability of this technique, and we hope to report on these results in due course.

(We thank Eddie Bateman for this interesting news item).

Chalk Fossils



On the left of picture is the ammonite cast, on the right the scallop shell.

Work on the Nimrod mound site has brought to light evidence of life on Earth aeons ago. From the Chalk has been recovered the fossilised remains of molluscs which inhabited the warm shallow seas of the Upper Cretaceous Period 135 - 70 million years ago. Chalk is a young (by geological standards) sedimentary rock - a fine white limestone deposited in layers, which in SE England consists of the skeletal platelets of an animal plankton called formaminifera, some finely ground shell, and a high proportion of material from single-cell planktonic algae. Many plants and animals secrete Calcium Carbonate and on death the skeltons, may in the absence of other sedimentary material accumulate to form limestone.

Sedimentary rocks provide by far the most complete record of the Earth's history. First of all, they constitute about 75% of all exposed rocks; second, they alone form at natural temperatures and pressures at the Earth's surface and finally they are the only rocks that generally contain fossils, and fossils not only record the history of life, but they are by far the best tools we have for correlation. Sedimentary rocks are stratified and this is their most conspicuous characteristic. In this area the bedding planes later became tilted slightly downwards towards the South East, and erosion of the softer surface rocks has exposed the chalk downs.

Many of the creatures that lived in the seas when the chalk was in the process of deposition have been preserved as fossils, particularly sea-urchins, lamellibranchs, belemnites, brachiopods and ammonites.

The specimens we have would appear to be a lamellibranch, very akin to a scallop and the cast of an ammonite.

RUTHERFORD WIVES COFFEE MORNING

The December coffee morning will be held on Wednesday 6 December from 10.30 am at the Cosener's House, Abingdon. All wives (and young children) are welcome. For further information contact Suzanne Litchfield - Abingdon 21310, Julie McGeoch - Oxford 722781, or Gillian Litt - Abingdon 26009.

SUPERANNUATION NOMINATION FOR DEATH BENEFIT

The recent death of an employee has highlighted the unnecessary delay which can occur in the payment of any lump sum death benefit when a married employee has failed to nominate her husband or wife to receive such payment. All married members of the UKAEA and SRC Superannuation Schemes are reminded that payment of death benefits can be made ahead of probate being granted, if they have made a valid nomination. Thus hardship and distress may be alleviated for their family.

Nomination forms are available from Miss M E Fry - Personnel Group. Ext 495.

EXPORT ARRANGEMENTS

The last dates for delivery of consignments to R & D R56 for EXPORT prior to the Christmas Holidays by normal arrangements are as follows;-

By AIR - Midday MON 18 DECEMBER
By ROAD - Midday TUES 12 DECEMBER

Normal services will be resumed the week beginning 8 JANUARY 1979. There will also be some restriction of IMPORT movements.

CIVIL SERVICE MOTORING ASSOCIATION

Mr Len Fontana, the Norman Frizzell representative will be at the Rutherford Laboratory on Mon. 4 Dec and again in January. Len will answer queries on Motor Insurance. Will anyone wishing to see Len, or wanting to join the CSMA please contact Ron Hogan Ext 284.

FILM NOTICE

Period 13 commences on Monday 4 Dec. Colour Strip PURPLE. Please change your film promptly and return all old ones. Anyone needing a new holder please contact Jenny Coates Ext 430.

MUSIC

Another informal session, live at the Yamaha by "JONATHAN AT THE ORGAN" will be held on 13 December in the Lecture Theatre from 1230 - 1330 hrs. He will play the usual cross-section of music - come and enjoy it!

THANK YOU

Jean Ling would like to thank all her friends and colleagues at the Rutherford Laboratory for her lovely leaving present. She says she misses you all, and promises/threatens to 'drop-in' in the near future.

RUTHERFORD LABORATORY BULLETIN

Deadline for Insertions

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