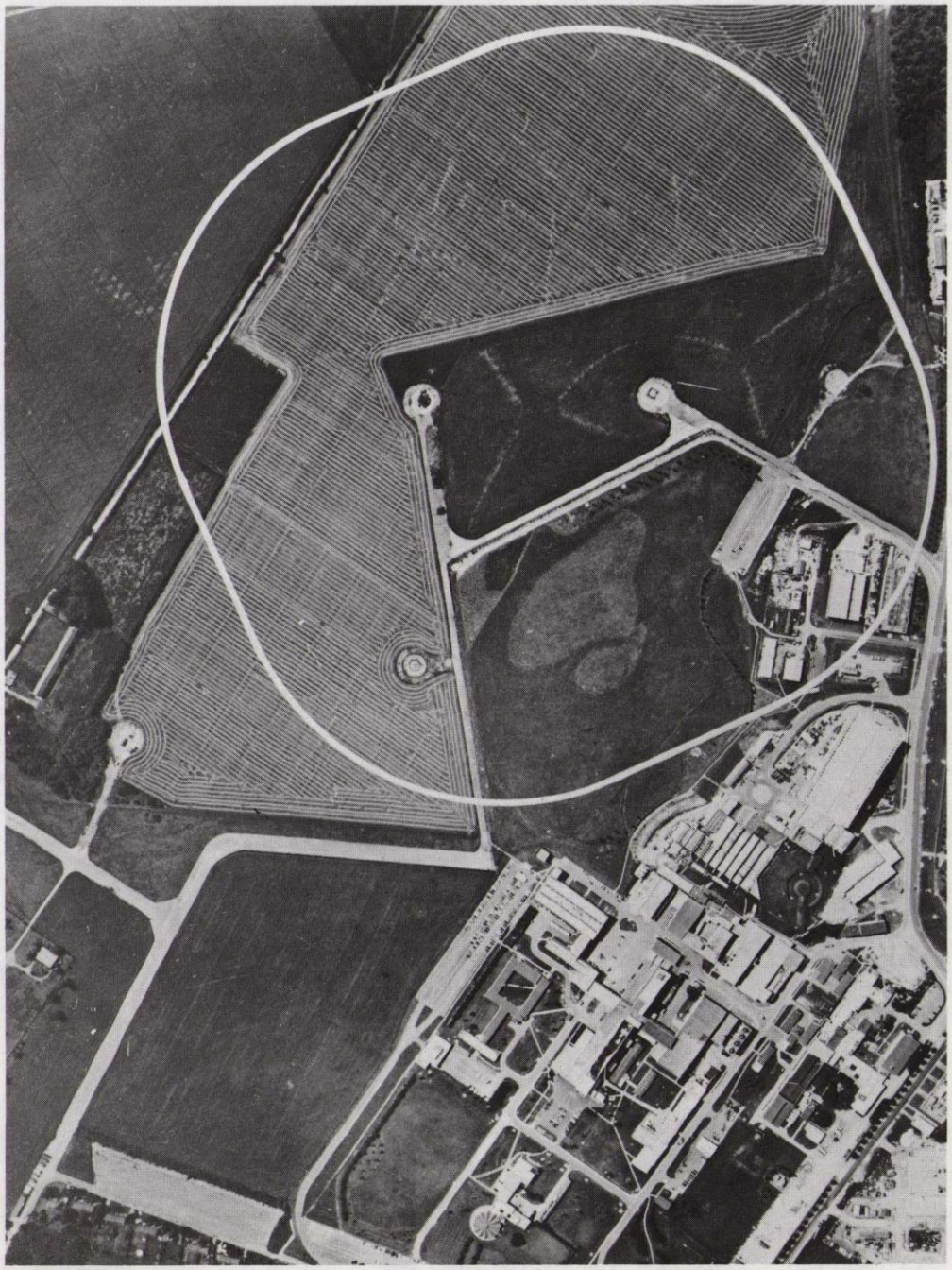
Rutherford Laboratory

23 September-7 October 1974

bulletin 19

A SKYLARK'S VIEW



An aerial photograph of the Lab; superimposed is the outline position of the proposed tunnel for EPIC.

INTERNAL EVENTS

NIMROD LECTURE SERIES
Monday 23 September
11.30
Lecture Theatre

Asymptotic Freedom

Dr G G Ross/Rutherford Laboratory

NUCLEAR PLYSICS GROUP SEMINAR
Tuesday 24 September
11.00
Conference Room, Building R12

Physics with High Energy Nuclei at Berkeley - (A General Survey of the Bevalac Project)
Professor Lee Schroeder/L.B.L, University of California

NIMROD LECTURE SERIES
Monday 30 September
11.30
Lecture Theatre

ν Physics (London Conference Review Talk)

Dr D Cundy/CERN

HEP SEMINAR
Tuesday 1 October
11.00
Lecture Theatre

Some Experiments Done with the 1.3 GeV Electron Synchrotron of INS in Tokyo

S Yasumi/NLHEP, Japan

NIMROD LECTURE SERIES
Monday 7 October
11.30
Lecture Theatre

High Energy Elastic Scattering

Dr R J N Phillips/Rutherford

NIMROD SCHEDULE

CYCLE 8 10.9.74 – 1.10.74 MACHINE PHYSICS HIGH ENERGY PHYSICS

Team	Beam	Experiment	State
CERN/ORSAY/OXFORD	P81	Hadron-Proton Spin	Date
RUTHERFORD LABORATORY	π11	Beam Measurements	Tests & Data
IMPERIAL COLLEGE/RL	π8A	Experiments on Narrow Bosons X^{o} (958) S* and Cross-Section Measurements	Data
BEAM DETECTOR GROUP	K15A	Parasitic Running	Tests
COUNTER GROUP B/ CAMBRIDGE UNIVERSITY	π12	$\pi^{-}p \rightarrow K^{o}\Lambda^{o}$ in the Range 1.4 - 2.0 GeV/c	Setting up
RUTHERFORD LABORATORY	π9	Polarisation in the $\pi^{-}p \rightarrow \pi^{o}n$, nn	Data
BIRMINGHAM/SURREY/RL	K17	Stopping Kaons	Data
RCVD GROUP	P71		Tests

CYCLE 9 1.10.74-22.10.74 SCHEDULE AS FOR CYLCE 8.

STOP PRESS

VISITS BY PARLIAMENTARY CANDIDATES The three candidates for the Abingdon constituency will address members of staff in the Lecture Theatre on the following dates:-

Fri, 4 Oct, 12.45 pm - Denis Moriarty - Labour
Mon, 7 Oct, 1.00 pm - Airey Neave - Conservative
Tues,8 Oct, 1.00 pm - Michael Fogarty - Liberal

LIBRARY NOTICE The Library will be closed for ALL business, and that includes telephone enquiries, from 3 - 8 October inclusive. It will reopen on 9 October in it's new home which is Building R61.

CLAIMS OFFICE Until further notice the Claims Office in R20, will be manned part time in afternoons only.

RUTHERFORD LABORATORY BULLETIN *Published by the Scientific Administration Group*

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

A "SUPER" - CONDUCTING MAGNET

The latest success story to emerge from the Laboratory's Superconducting Magnet Research Group broke early last week, to be exact on the morning of 11 September, when a niobium-tin superconducting solenoid successfully ran to a peak field of 12.25 Tesla at 4.2K (1 Tesla is equal to 10,000 gauss ie 10 kilogauss, Tesla usually being shortened to T.). The solenoid, length 50 mm, inside diameter 30 mm, outside diameter 85 mm, utilising approximately 1 kilogram of superconductor, gave nearly 10T on its own, reaching 12.25T when placed in a background field provided by a 6.5T niobium-titanium solenoid. The maximum field obtained is in excellent agreement with that predicted from the short sample test and is the third of a series showing such agreement.

Before continuing the story of this very significant breakthrough it is perhaps useful to go back in history a little to 1961 when, following the improvements in low temperature techniques in the 50's, the superconductivity break through was achieved. Following intensive work, two materials became leaders, niobium-titanium and, niobium-tin. Niobium-titanium alloys have proved to be both strong and ductile whereas niobium-tin is strong but brittle although offering advantages in reaching higher fields and currents. Development continued using niobium-titanium until the late 60's when, as is well known, a collaboration between Imperial Metal Industries and the Rutherford Laboratory produced the composites now widely used, consisting of large numbers of extremely small wires of niobium-titanium, known as filaments embedded in (typically) a copper matrix.

Exploitation of niobium-tin in filamentary form has been delayed owing to its great brittleness as it breaks at strains of much less than 1%,(in fact, somewhere about 0.3%) and novel metallurgical techniques have had to be developed for its production. That such conductors have been developed is due to the excellent collaboration between the Process Technology Division at AERE and our own Superconducting Magnet Research Group. The new niobium-tin conductors use the same filamentary concept as the (now) conventional niobium titanium conductors already mentioned. They can however carry considerably more current (2000 Amps/mm^2 in a niobium-tin composite versus 800 Amps/mm^2 in a niobium-titanium composite) and will work at much higher fields (20 T as opposed to 10T) and temperatures (18K as opposed to 9K.

How has this breakthrough come about? Basically, the conductor starts life as a composite of niobium rods in a copper-tin bronze. This is then reduced by normal mechanical deformation processes (ie drawing out) to the final wire size. The conductor is insulated with a glass fibre braid and wound on a stainless steel former; it is then reacted in a vacuum furnace at temperatures between 600 and 750°C. What follows in this reaction process is that the tin diffuses from the bronze to the niobium wires and forms a layer of niobium-tin at the interface.

The photograph of a cross-section through a partially reacted sample of the 5143 composite shows the niobium-tin layer surrounding the unreacted niobium filaments. The magnification is about X700. (See Fig 1)

After formation the conductor is rather susceptible to damage although considerable protection is given by the epoxy resin in which the conductor (ie the coil) is encapsulated. One has to remember the considerable strains and stresses which are inherent in such a coil when it is subjected to the forces brought about by the very considerable flow of current flowing through it. The fact that the last 3 coils have performed to their short sample characteristics shows that the "wind and react" procedure is a perfectly feasible method for avoiding damage.

The photograph of the conductor used for the 12T coil shows not only the 5143 superconducting filaments but also 24 hexagonal regions of high purity copper surrounded by a diffusion barrier. The conductor is 1.02 mm in diameter, and picture shown is about X80 in magnification. (See Fig 2)

The copper has two functions - first to conduct heat away from regions where flux jump or other instabilities occur and second to provide a low resistance shunt for the coil when it quenches, thus minimising the internal voltages and temperature. The resulting conductor is thus a sophisticated multi-component material which should eventually find wide application in High Energy Physics for magnets in the range of fields up to 15 T.

The Editor is grateful to David Larbalestier, a member of the Superconducting Magnet Group for supplying the major part of the material for this article. Both David and Chris Scott are leaving shortly to attend the Conference on Applied Superconductivity to be held at Chicago where between them they will be presenting some five papers. Colin Walters who has spent the last 12 months at Brookhaven on an exchange visit with Al McInturff will also present a paper at the Conference. Al McInturff is a co author with David of one of the papers to be presented.

Both David & Chris have promised to produce, on their return, an article for the Bulletin on the 'present state of art' as presented at the Conference.

One final word, it does seem, and the Conference should confirm this, that the Rutherford Laboratory through its Superconducting Magnet Research Group is still in a leading position in the world when it comes to this type of research.

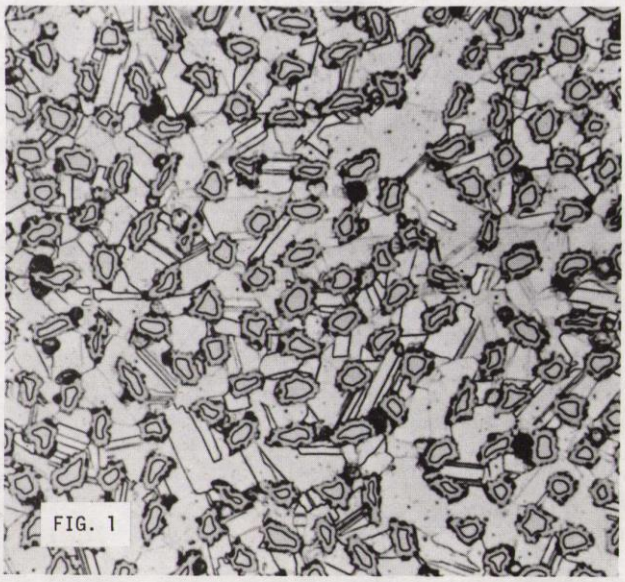

FIG. 1

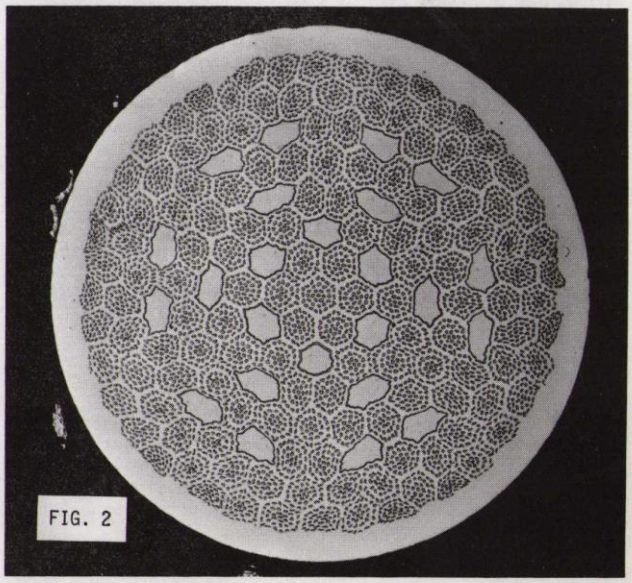

FIG. 2

OVERSEAS VISITS Dr J J Thresher is in Russia (see Bulletin No 18) as a guest of the Academy of Sciences of the USSR.
Dr N H Lipman, to CERN, 23-25 September to attend Neutrino Collaboration Meeting.
Mr P J Bowles and Mr K C Myers, to CERN, 23-26 September to attend CERN Safety Conference.
Mr F Atchison and Mr F S Gilbert, to CERN, 23-27 September for discussions on fast kicker magnets, associated power systems and high definition CCTV.
Dr K Sumorok, to CERN, 23 September - 17 October for data taking.
Dr M R Jane, to CERN, 29 September - 9 October to participate in Omega Neutron Counter Run.
Mr N M King and Mr M H R Donald, to CERN, 29 September - 12 October, to participate in a Performance Study on pp Storage Rings of Several Hundred GeV.
The Director, to CERN, 30 September - 3 October, to attend meetings of Scientific Policy Committee and CERN Committee of Council.

BASQUE SOLENOID A telex message has been received from Roy Brown, a member of the Basque experimental team, to say that the Super-conducting Solenoid has been tested off-line at TRIUMF and that its performance was as expected. It goes to show that superconducting magnets can be operated without the benefit of extensive experience in the art of cryogenics and superconductors.

SHIP AHOY The recent collection for the Civil Service and Post Office Lifeboat Fund realised the magnificent sum of £45.66. Many thanks to those who contributed so generously and a special thank-you to the members of staff who undertook the task of collecting the sum.

FOUND A piece of jewellery in the form of a cross and chain has been found by the cooling towers. Enquiries to Peggy Shipley, Bldg R12, Ext 441.

FILM BADGE NOTICE Period 10 commenced Monday 9 September. Colour Strip - GREEN for βγ film and neutron packs. Please make sure you are wearing the correct dosimeter and that all old ones have been returned.

TELEPHONE DIRECTORY A new Telephone Directory is being prepared. Requests for alterations, additions or deletions to the existing Directory, which have not already been notified, should be made in writing and sent to the Accommodation Office, Room 2.26, Building R1 before 11 October, 1974.

SOCIAL NEWS

SOCCER Total commitment by these two teams plus the added incentive that they finished winners and runners-up respectively of Division B last season gave this Division one game on Monday, 9 September between Atlas and Taylors, the necessary ingredients for a truly great match. The result, a win for Taylors by four goals to three.

The game was just six minutes old when John Peterson shot Atlas into the lead, but almost before the ink had dried in the Referees book, Taylors had pulled this one back with a typical Paul Eddowes goal, play quickly switched from end to end with neither team in full control for long. In the tenth minute Atlas had an element of luck about their second goal from Duncan Denton which hit a defender as it went through a ruck of players, again their lead was short-lived, as a perfectly placed shot from this hard-working man, Eddowes, put the scores level.

The second half was just 3 minutes old when Taylors took the lead, for the first time in the match. Martin Birmingham finishing off a fine combined move to beat Rolfe all the way with a crisp shot. Shortly afterwards, Guest had bad luck with one which rattled the contractors crossbar. It was following an indirect free kick that the same player finally gained just reward for his efforts with a shot in off the post. The game really came alive when, with 9 minutes remaining, Chris Russell put Taylor's back in front.

It was unfortunate that the only black spot in the game had to result in a Taylor man being given his marching orders. Atlas tried desperately hard to get back on terms but Taylors, despite having only six men, held on to win.

Nomads and Transport gained their first point of the season when they met on Thursday 12th September in a Division 2 game which ended in a goal-less draw. Both teams were guilty of glaring misses and the game should go down as one of mischances.

RESULTS

Mon	9/9	Atlas	- 3, Taylors	- 4	Group 1
Wed	11/9	Atlas	- 2, R9	- 2	Group 1
Thurs	12/9	Nomads	- 0, Transport	- 0	Group 2
Mon	16/9	R9	- 4, Atlas	- 2	Group 1
Tues	17/9	CA	- 2, Taylors	- 1	Group 1

FIXTURES

		Group 1	Group 2
Mon	23/9	Taylors V Atlas	
Tues	24/9	R9 V CA	
Wed	25/9		Nomads V R25
Thurs	26/9	Taylors V CA	
Fri	27/9		Transport V Nomads

BADMINTON Anyone interested in taking part in the Civil Service Inter-Departmental Badminton Team Championship 1974-75 as a member of an SRC team should contact Mr G Howard Ext 6115 as soon as possible for further information.

DATE FOR YOUR DIARY An Administration Division Dance will be held on Saturday 7 December from 8 pm until midnight, in the Rutherford Laboratory restaurant to the music of "The Goodtymes". Please note the date - a further announcement about tickets will be made soon.

CHRISTIAN FELLOWSHIP Friday 27 September. A time of fellowship will be held in the Conference Room, Building R12 at 12.30.

Friday 4 October. This month our prayer meeting will be led by Jimmy Darius of Building R12. All are welcome to attend and requests for prayer can be passed to any member of the Fellowship. The meeting commences at 12.30 in the Conference Room, Building R12.