25 June-2 July 1973

Rutherford Laboratory

bulletin 23

REPORT ON THE FRASCATI CONFERENCE ON INSTRUMENTATION

The construction of the SPS accelerator at CERN and the operation of the NAL accelerator at 300 and 400 GeV/c have stimulated a new look at instrumentation for high energy physics.

The 1973 International Conference on Instrumentation at Frascati, 8 - 12 May provided a wealth of detailed information on new techniques in addition to some excellent Frascati wine and sunshine! - both much appreciated by the UK participants. Social evenings took in two excellent dinner parties and a superb concert. The Philistine nature of the "non-typical" physicist was revealed however: after a magnificent evening listening to a superb choir in an ancient church, returning to the hotel by coach with the lights of Rome in the distance a rather loud American voice was heard to remark "And then we had to wait six agonising microseconds for the mu to decay". So much for ancient Rome, the Opera and the spiritual man.

On physics, a no doubt biased selection of thoughts received or transmitted are given below.

As energies increase it becomes more difficult to resolve one kind of process from another. To obtain a clean sample of a given reaction in general requires the application of detailed energy and momentum balance constraints which are only effective if momentum and angles are measured with high precision. Hence the need for the development of high space precision detectors. Equally important is the identification of very fast charged particles both for inclusive and exclusive physics.

The dimensions, magnetic fields and cost of the spectrometer systems required are determined by the ability to locate accurately the tragectory of a given particle in space. The development of high precision detectors such as drift chambers which can also tolerate high event rates is therefore of great significance. It was anticipated that a relative space location accuracy down to ≈ 0.1 mm over distances of many tens of metres could be achieved. In the absence of multiple scattering (!) an improvement in the space precision by a factor 4 represents a halving of the linear dimensions of the spectrometer system required to reach a given energy for full analysis. Alternatively, existing detectors such as Omega can be used to twice the anticipated energy if a factor 4 can be achieved in space precision.

Interesting developments in bubble chamber physics came from two directions both well known at the Rutherford Laboratory. At 100 GeV/c, typically four out of five interactions involve the production of more than one neutral π-meson. These events cannot be analysed using charged particle measurements alone. The ability to detect gamma rays from the π^0 meson decay using the Track Sensitive Target (T S T) technique is clearly therefore of great importance. No other technique has this property at present and the role of the bubble chamber in taking a global look at particle interactions will clearly be continued. The advantages of using large volume T S T's in the big European bubble chamber, BEBC, for neutrino interactions were also strongly emphasised.

The 40" bubble chamber at SLAC, operating at 10 cycles per second, in a hibrid made with a forward particle single magnet spectrometer, has completed several experiments. The growth time of ∿ 3 ms for the bubbles is utilized to compute a missing mass trigger in the study of the proton diffraction dissociation by 14 GeV/c π^-. It is clearly possible to extend this idea and make fairly sophisticated triggering using the long memory time involved in bubble growth.

Streamer chamber developments were reported from DESY and SLAC. The principal advantage of the streamer chamber over the bubble chamber is that it can operate in an unseparated beam. This may be critical in the SPS North Area for example. Space precision in the range 0.2 - 0.5 mm and time resolution ∿ 1 μsec with excellent multiparticle efficiency was reported. The disadvantages would seem to be that the technique is visual so that an extremely high trigger rejection ratio (∿ 1 in 10^4) is required to make use of the potential rate on small cross section processes. The interaction vertex is not seen and the track efficiency falls off beyond about 50 - 60° to the electric field vector.

Particle identification techniques were discussed and indicated that the rise in dE/dx for the noble gases will in principle allow, for example, particle identification in a large streamer chamber up to ∿ 80 GeV/c. Transition radiation has the very nice property that the intensity increases linearly (in the X-ray region) with the energy of the particle and for a given energy particle is proportional to one over the vast mass.

Particle separation above about 300 - 400 GeV/c looks possible using this technique. Sophisticated Cerenkov radiation detectors (DISC's) can probably fill the gap. Interesting information was reported on many other topics from large 1000 lb crystals of Sodium Iodide (at $35,000 each) for gamma and electron energy measurements in TASC (0.7% energy resolution at 15 GeV/c) to very high space precisions (~ 15μm) using 3.5 μm wires in small liquid Xenon wire chambers.

A consequence of the developments in high speed acquisition is the problem of how to digest the flood of data of up to 10^8 events/second. Large computers are clearly too slow by several orders or magnitude and data storage problems become immense. The message seems to be special purpose hardware used on line for preliminary filtering or even triggering (as for the SLAC RCC) and increased storage using Videc tapes. This may strike a CHORD with C and A.

General reaction: Everything is possible, it just costs a great deal of money and effort. If only one knew where to look it might just be possible to design the right counter.

The author must apologize for the biases and omissions in this report and for obvious reasons Dr Fisher prefers to remain anonymous.

FILM BADGE NOTICE

Period 7 commenced on Monday 18 June. Colour Strip - RED for βγ films and neutron packs.

Please check that you are wearing the correct films and that all old ones are returned.

INTERNAL EVENTS

NIMROD LECTURE SERIES
Monday 25 June
11.30
Lecture Theatre

Results on pp→pX from NAL

Dr I Siotis/Imperial College

APPLIED PHYSICS LECTURE
Monday 25 June
15.15
Lecture Theatre

Basic Concepts in Accelerators and Storage Rings - Part I

Dr J D Lawson/RHEL

Presentation of basic physical concepts; a knowledge of classical mechanics and electromagnetic theory will be assumed.

Copies of syllabus available from Dr J R Smith, Room 40, Building R20.

H.E.P. SEMINAR
Wednesday 27 June
11.00
Conference Room, Building R1

Partons - An Introduction to Introduction

Dr R Worden/RHEL

RUTHERFORD LABORATORY LECTURE
Thursday 28 June
15.15
Lecture Theatre

The Hydraulics Research Station

Mr H R A Dedow/Assistant Director, Hydraulics Research Station, Wallingford

SEMINAR IN COMPUTING
Friday 29 June

The lecture by Dr M Jane due to be given on 29 June has been postponed until further notice.

NIMROD LECTURE SERIES

There will be no lecture in this series on Monday 2 July. There will, however, be a lecture on Thursday 5 July by Dr R Rand of Stanford University on 'EM Interactions at SPEAR', at 11.30 in the Lecture Theatre.

NIMROD SCHEDULE

CYCLE 6 26 6 73 - 17 7 73

MACHINE PHYSICS

HIGH ENERGY PHYSICS

Team	Beam	Experiment	State
HBC/UCL/BRUSSELS	K19	Stopped K^- in H_2 - Track Sensitive Target	Data
BRISTOL/SOTON/RHEL	K15	$\pi^{\pm}$p Differential Cross-Sections	Data
CHURCHILL HOSPITAL/ BART'S MEDICAL COLLEGE/ RHEL	π11	Radiobiological and Iron Chambers Evaluation	Tests
COUNTER GROUPS A & C/ DETECTORS GROUP	π8	Proposal Studies and Detector Evaluation	Tests
BIRMINGHAM/SURREY/RHEL	K17	Stopping Kaons	Setting up
CERN/ORSAY/OXFORD	P81	Hadron-Proton Spin	Setting up

EXTERNAL EVENTS

ABINGDON LECTURE SERIES
Tuesday 26 June
14.00
Lecture Theatre, DNPL

Seminar on Proportional and Drift Chambers

The programme is as follows:-

First Session at 14.00

Opening Remarks	*E Gabathuler/DNPL*
Introduction to Proportional and Drift Chambers	*K Stephens/Mancaster*
Mancaster II Proportional Chambers	*R Lawson/Mancaster*
LAMP Proportional Chambers	*R Cunningham/DNPL*
Mechanical Construction of Chambers	*D Taylor/DNPL*
Proportional Chamber Work at Durham	*R Browell/Durham*
Discussion followed by Interval	

Second Session at 15.45

Electronics for Proportional Chambers	*A Peatfield/DNPL*
Development of Drift Chambers	*K Connell/DNPL*
Electronics for Drift Chambers	*K Short/Durham*
Drift Chamber Work at Durham	*M Breare/Durham*
Discussion	

HIGH ENERGY NUCLEAR PHYSICS COLLOQUIUM
Wednesday 27 June
16.00
Room 536, Imperial College

Four - Body Final States in 10 GeV/c K^-p Interactions

Dr P Schmid/Imperial College

INSTITUTE OF MATHS LECTURE
Wednesday 27 June
17.30
U C L (Chem. L.Th., Gordon St.)

Applications of Probability to the Real World: Physics and Fractional Dimension

Dr Benoit Mandelbrot/IBM Research Laboratories, New York

ELEMENTARY PARTICLE PHYSICS SEMINAR
Friday, 29 June
14.20
Nuclear Physics Building,Oxford

Shadow Approach to Elastic Scattering

E H de Groot/Oxford

TELEPHONE DIRECTORY ALTERATIONS AS AT 18/6/73

ADDITIONS

ROWE MISS C R	500	R20 66	ADM PER	
JUNKISON MRS P	6256	R1 1.77	ADM GA	
WATERS M W	6251	R1 1.24	HEP BCR	
MURPHY R	6249	R12	ENG S	
BARNETT MRS K	6299	R20 45	ADM FA	
PARKER N M	6388	AL 67	AL	
KRAEMER DR R W	302	R1 1.78	HEP	
STEVENSON MRS S W	6299	R20 45	ADM FA	
LEWIS D E	6638	R18	ENG ESD	

AMENDMENTS

WYARD M H J	delete 362	add 6638
DEW D	delete 489 213	add 548 6658
MAIDMENT MRS J	delete 6163	add 384
WATERS G	delete 6130	add 6240
WHITE D J	delete 6129	add 6240
MORRIS D A	delete 308	add 6240
WHITE D E A	delete 386	add 231
COOPER J S	delete 6259	add 536
CLARINGBOLD MRS L J	delete 6257 6354	add 6613
DAWSON MRS A	delete 6257	add 6640
KRAUESSLAR MRS E A	delete 6257	add 6384

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

RUTHERFORD LABORATORY LECTURE

'The Hydraulics Research Station' is the title of the next lecture in the Rutherford Laboratory Lecture Series to be given by Mr H R A Dedow, the Assistant Director of the Hydraulics Research Station, Wallingford, on Thursday 28 June at 15.15 in the Lecture Theatre.

Mr Dedow has kindly supplied the following summary to his talk:-

> 'I shall open with a brief resume of the origins of the Hydraulics Research Station, and follow this with a 16mm sound film which describes the work of the station. I will then briefly describe some of the major investigations currently in progress, such as water storage in the Wash and Morecambe Bay, and the Third London Airport at Maplin. Finally, if time permits, I shall include some comments on recent developments in mathematical modelling and the relationship of physical and mathematical models in hydraulic research.'

Anyone who has had the opportunity to visit the Station on one of their Open Days will have experienced the fascination of the very skillfully made working scale models of harbours, rivers, bays etc with tides rising and falling every few minutes. Definitely a lecture and film not to be missed.

HOLES TO ORDER

An electro-discharge machine (more commonly known as a 'spark eroder') has been installed in R9 Mechanical Manufacturing Workshop. This machine can be used for cutting holes of almost any shape in most metals including tungsten, tungsten-carbide, hardened steel etc. As no cutting forces are involved, thin foils can also be machined.

Anybody requiring this facility should contact Malcolm Arnold on Ext. 558.

BULLETIN NOTICE

The Editor apologises for the absence of our usual mast head due to unavoidable production difficulties.

OVERSEAS VISITS

Mr R Wimblett leaves on Saturday 23 June for a 13 months secondment to Triumf, UBC Vancouver Canada where he will be concerned with the Basque project and the setting up of LH_2 Target Section.

Dr Fayyazuddin, to Italy, 25-30 June, to attend Topical Meeting on Weak Interactions at the International Centre for Theoretical Physics at Trieste.

SOCIAL NEWS

CHRISTIAN FELLOWSHIP

What is your Destiny? Dr John Savage of the MRC will be concluding his series 'A Christian View of Man' with the subject 'The Destiny of Man'.

If you would like to know more of what Christians believe on this vital subject, why not come along for this half-hour talk and discussion? The meeting commences at 12.30 on Friday 29 June in the Conference Room, Building R12.

RUTHERFORD FOLK CLUB

Advance notice of the next meeting of the Folk Club on Friday 6 July so reserve that evening for a big attraction, the 'BG and W Steam Band'.

3 boys, founder members of the "Orange Blossom Sound" who made several LPs under that name. The music - Traditional, Country, Folk and the instruments - banjo, mandolin, guitar etc.

So dont forget - Friday 6 July in the Restaurant Coffee Lounge at 8 pm.