Bulletin
of the Rutherford Appleton Laboratory 4 July 1983 No.10

Wind - Diesel Partnership

A large potential demand exists for electricity in remote areas isolated from grid supply. The high cost of diesel generation, especially in the developing countries, has prompted an examination of integrated wind/diesel systems, with the wind turbine viewed primarily as a fuel saver.

The Energy Research Support Unit at RAL together with teams from Imperial College and Hawker Siddeley Power Plant Limited (HSPP) (leading suppliers of small diesel generating sets) has recently begun a study which will concentrate on the transient behaviour of such systems, making extensive use of computer simulation techniques.

Wind energy, in common with most renewable energy forms, is intermittent and so alone cannot be relied upon to provide a continuous electricity supply. For this reason the wind turbine has hitherto been ignored as an electrical generating source in grid-isolated communities in favour of the diesel generator. However as the cost of diesel fuel increases, interest in the use of wind turbines, backed by diesel generators, has been rekindled. But there are problems. So far wind turbine technology has been concentrated on optimising the efficiency of the hardware and integrating it into large grid systems where short-term wind and load variations are small in relation to the overall capacity. Small rural systems have to deal with widely and possibly rapidly fluctuating loads and are thus more difficult to control.

Hybrid Solution

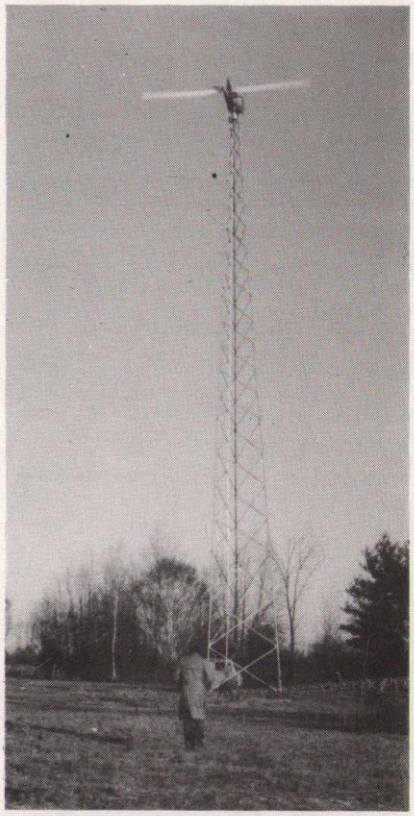
A hybrid system, on the face of it, offers an ideal solution, but research has indicated a number of obstacles to the realisation of a successful wind/diesel package. It has been found that the back-up diesel generator is forced, by the variability of the wind turbine output and the consumer load, to undergo too many stop/start cycles, and may often be forced to run at low load conditions. This is expected to increase wear and tear and hence maintenance costs. Difficulty in fixing the wind-turbine size in relation to the installed diesel capacity, especially when the turbine is being integrated into an existing system is also a problem, as is the short-term variation of turbine output, in response to wind turbulence, which causes unacceptable variation in both the voltage and frequency of the supply.

Three Year Study

Over the next three years the collaboration will make an intensive study of all these problems. The characteristics of a test diesel set will be thoroughly assessed through monitoring under differing load conditions. The performance of a new aerogenerator with a 9 metre (30ft) diameter rotor on a 18 metre (60feet) tower will be measured and a number of different control strategies will be evaluated. Load profile data based on the study of an artificially isolated community (Abertridwr, Wales - see Bulletin No.10 1981) will be provided by a computer controlled load device.

Results from the study will be used to develop a control strategy which optimises the wind energy contribution, subject to the constraints or power quality, and the operational characteristics of the diesel back-up. It is intended to implement the final, and probably quite complex control algorithm, via a microprocessor which will become a vital part of the wind/diesel package.

The research developments will also take note of the types of applications envisaged for such systems. These are expected to be mainly in the developing countries where a very large market for diesel sets exists. With the assistance of the experienced teams at RAL and Imperial College, HSPP are confident of being able to make an early entry into this market place. They hope to be able to offer a reliable integrated package which may either be retrofitted to existing diesel installations or installed at the same time as the new diesel set.



The aerogenerator which will be used for the study. (Photo. HSSP)

And the next object is the ZZZ

Don't assume that this means that particle physicists have been asleep during "20 Questions". Far from it in fact!! One major scientific discovery in a year would normally be thought of as a triumph, but two such discoveries could be considered just greedy! However, this is what has happened in Particle Physics in 1983.

Following in the footsteps of their observation of the $W^{\pm}$ and W^{-} (*see Bulletin No 2 1983*), the UA1 team at CERN has recently announced that they have found five events in their present run where the neutral partner of the Ws, namely the Z^{o} (called Z-Zero), has been produced in very high energy proton-antiproton collisions. Four of the Z^{o} events were observed to decay into an electron and a positron and the other into a negative and a positive muon.

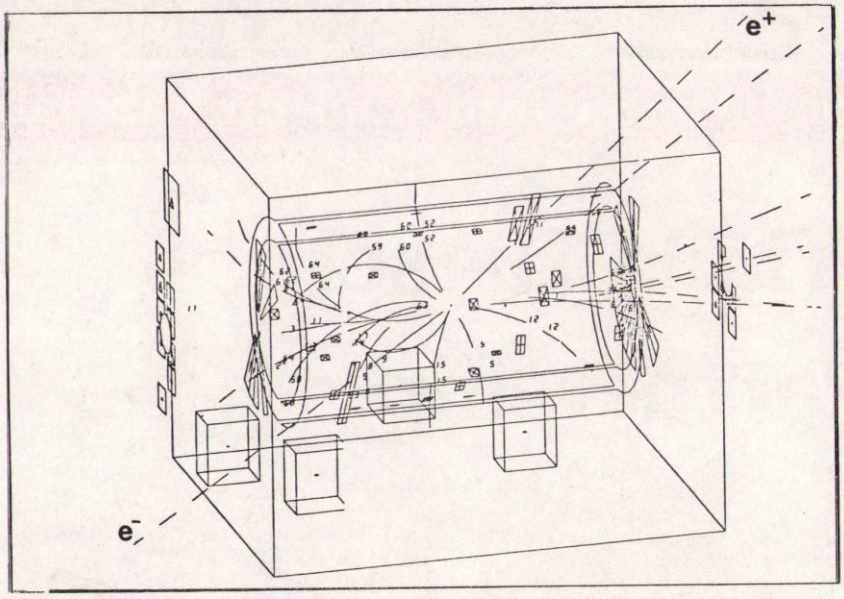
Why is this so important?

This is a vital further discovery since it completes the theoretical picture proposed by Glashow, Salam and Weinberg for the unification of the weak and electromagnetic interactions. They received the Nobel Prize in 1979 for this theoretical work. These two forces were believed to lead to completely unrelated phenomena. The weak force is responsible for radioactivity and plays a major role in the production of energy in the Sun, while the electromagnetic force is concerned with the behaviour of charges in electric and magnetic fields (eg attraction and repulsion between unlike and like charges - electric motors and dynamos, radio and T V broadcasting etc).

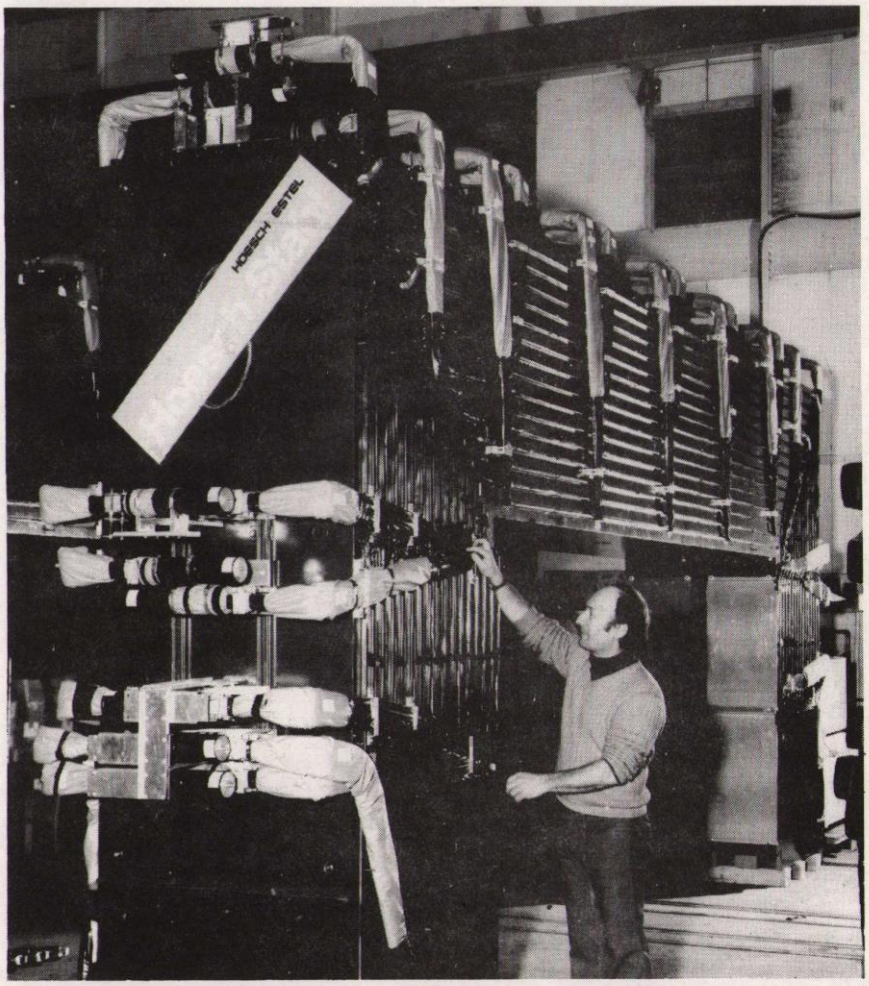
This theoretical model, known as $SU(2)_{x}U(1)$ in the trade, predicted the existence of three very heavy particles called *"Intermediate Vector Bosons"* and christened "W^{+}, W^{-} and Z^{o}". The masses of these particles were also predicted using the known strengths of the weak and electromagnetic interactions, and these were given as 82 and 93 GeV for the Ws and Z^{o} respectively. To give these masses a scale, the proton mass is only 1 GeV. This is all beautifully confirmed by the UA1 experiment which measures a mass of 81±2 GeV for the Ws and 95±3 GeV for the Z^{o}.

Where does the UK fit in?

UA1 is a collaborative effort between 12 scientific institutes, including the University of Birmingham, Queen Mary College London and RAL. In terms of manpower the UK groups contributed 26 physicists out of 135 and have played an important part in many aspects of the work. The apparatus, which was constructed and operated by the UK has already been described in *Bulletin No 1, 1981*. To recap briefly they



Two very high-energy tracks in the above event represent an electron and a positron. They come from the decay of a Z^{o} into an electro-positron pair. The near back-to-backness of the electron and positron in this event reflects the slowness of the Z^{o} that decayed.



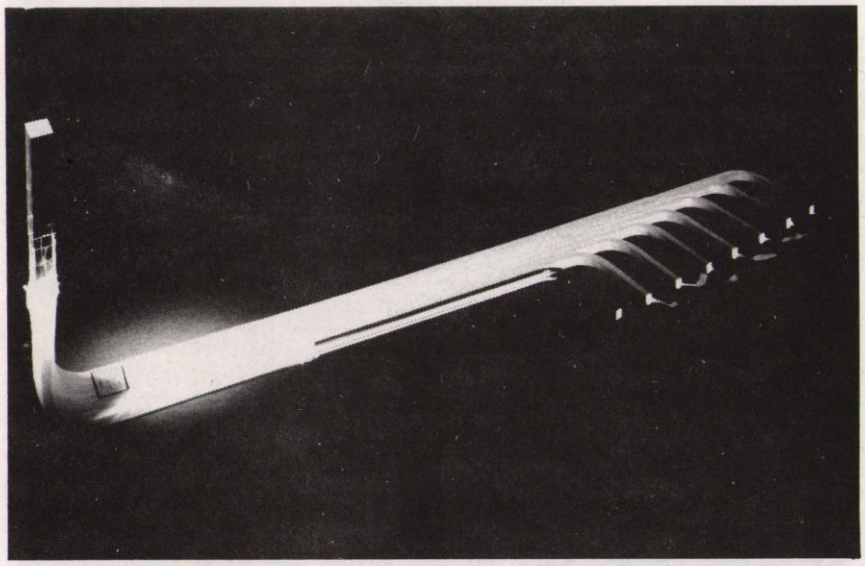
The view from the rear of the racks shows the cabling required to interconnect processors, analogue-to-digital converters and, at the bottom of the cables, spy units.

The total system contains approximately 25,000 integrated circuits and has more than 500,000 wire-wrapped joints. (34869)

The top two rows of crates in the racks together form two identical digital processors, each one of which can decide in less than one microsecond whether to accept or reject an event. One processor decides on the basis of the total energy of the event, the other on the basis of the transverse energy.

Below these are the fast analogue-to-digital converters which provide the processors with data to 8 bite accuracy in half a microsecond. (34863)

A set of eight light-guides. Eight light-guides view one side of each of eight scintillator plates and guide light to one photomultiplier (PM) tube. The PM tube is read out for every event and the reading measures the amount of energy deposited.



The calorimeter comprises 40 tonnes of scintillator in the shape of 6000 plates with read-out via 10,000 wave-shift bars each of which is viewed by a light guide. The plates are interleaved with the laminations of the C-shaped magnet yoke. The plastic covered light guides can be seen in the photograph emerging from between the laminations. (Photo: CERN)

constructed the massive iron and scintillator calorimeter which measures the total energy of all of the hadrons (the strongly interacting particles) in the events. This calorimeter has played a crucial role in not only measuring hadronic energy, but also in the identification of the high energy electrons produced in W and Z decays.

What next?

The UK was also responsible for the electronic processor which enabled the physicists to trigger the detector on only the very rare and interesting events. Here very special thanks must go to the RAL Electronics Group for their excellent job in producing this processor and for their untiring enthusiasm and skill, and to the Physics Apparatus Group who coordinated the construction of the calorimeter and provided the group with enormous amounts of effort during the preparatory stages of the experiment. Without this support the experiment would have represented an insurmountable task!

The UK is also very heavily involved in the analysis of the experiment and expects to continue analysing the results for some time to come. The present run ends at the beginning of July and no more data will be taken before the Autumn of 1984. Until then the physicists will be searching the data for other exciting phenomena. Evidence for the sixth kind of quark, the top quark, may well be lurking in the events, but will require close scrutiny to find. It should also be possible to study the interactions between the various constituents in the protons and antiprotons. These studies will be a good testing ground for the current favourite theory of the strong interactions, called Quantum Chromodynamics (QCD to the experts!)

Obviously the UK physicists are presently feeling very pleased with their results ... but hold on ... There may be more to come!

R J Homer

Computing Seminars

The next lecture in this series will take place on Tuesday 12 July at 3.15 pm in The Colloquium, Atlas Centre, R27.

THE SNS DATA ACQUISITION AND ANALYSIS SYSTEM
by
Dr M W Johnson

The PUNCH system (Pulsed Neutron Computer Hierarchy) is designed to provide an integrated instrument control, data acquisition and analysis system for the Spallation Neutron Source (SNS). Eventually the system will encompass approximately 20 neutron scattering instruments, each containing between 100 and 10,000 neutron detectors. Dr Johnson is a member of Neutron Division, and is responsible for the design and construction of the PUNCH system together with specific SNS instruments.

Last Mail for Jean

Jean proudly surveys her gifts, with Trevor (left) and David (right).

'Chirpy and Cheerful', was how Jean Eustace was described at a presentation, attended by her many friends and colleagues, to mark her retirement from RAL.

At the ceremony, held on 22 June, the life of this very popular messenger was flashed before her eyes for her by David Rawlinson and Trevor Hyman, who overwhelmed her with kind words (so she said) and showered her with gifts on behalf of all her friends at the Laboratory. From her admirers of the 'Lab' she received a magnificent set of garden furniture, two pots of flowers and 'a pot of gold' (a cheque). Two large cards were needed to accommodate the signatures of all who wished her well. Her 'customers' of SNS and Neutron Divisions showed their appreciation, with a beautiful carriage clock, flowers - and another pot-of-gold, presented on their behalf by Trevor Hyman.

Jean thanked everyone 'very much'. The gifts and kind things said of her, had left her speechless, she said. She had enjoyed working at RAL and wished the Lab and everyone in it, all the best for the future.

Stores Soccer

On 21st June at 5.30 p.m. the annual Stores soccer match took place between R40 (Heavy Metal) and R56 (Despatches) with carefully selected players from other areas. R40 started as slight favourites, and by half time were leading by 2 Goals to nil. After refreshments, and a very strong team talk at the interval, R56 made the full time score 3 all. Despite the immense heat and cries of despair, extra time of 10 minutes each half was played. The final score was R56 6 Goals R40 5 Goals, thus proving that the strenuous fitness campaigns undertaken in recent weeks by the R56 Team, paid dividends. We would like to pay our grateful thanks to the Referee P Moss who only had to show the yellow card three times. A tiring but enjoyable evening was held by all, the only injuries sustained being one set of bruised ribs, cuts and many aching limbs.

Sales to Employees

The sale of scrap metal and plastics will take place on 1, 15 and 29 July at the R40 scrap compound from 1200 - 1230 hrs.

Thanks

Thank you to all my friends and colleagues in HEP for the lovely cutlery they gave David and me for our wedding present. Also thanks very much to all The Girls for the beautiful Wedgewood set. Sorry I was unable to thank everyone personally at my presentation.

Jane Brown (nee Cameron)

Jean Eustace would like to say thank you very much to everyone who subscribed so generously to her retirement presents, and to say cheerio to all those she was unable to see.

Library Notice

Would the person who has the book 'Interactive Computer Graphics; Data Structures, Algorithms, Languages' by W K Giloi, please return it to the Computer Library, R27.

Missing

The following item is the subject of a loss report, would anyone having information as to its whereabout please contact E T Gourley, Ext. 5573.
1.3/8" Wolf electric drill No. 10921
Lost from R58.

Simon Caller has mislaid a pair of black, close-fitting cycling trousers with ankle zips. They were lost on 7 June in the R25 area. If found please contact him on Ext. 5555.

Undelivered Mail

An envelope full of typed abstracts and worksheets, together with a yellow punched tape, has gone astray in the internal RAL/Harwell mail. The papers are headed INIS and should be sent to the Library, R61 for the attention of Mrs E Marsh.

Film Badge Notice

It is PERIOD 7, Colour Strip YELLOW
Please check that you are wearing the correct dosimeter and that all old ones are returned.

Bulletin

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Deadline for insertions: