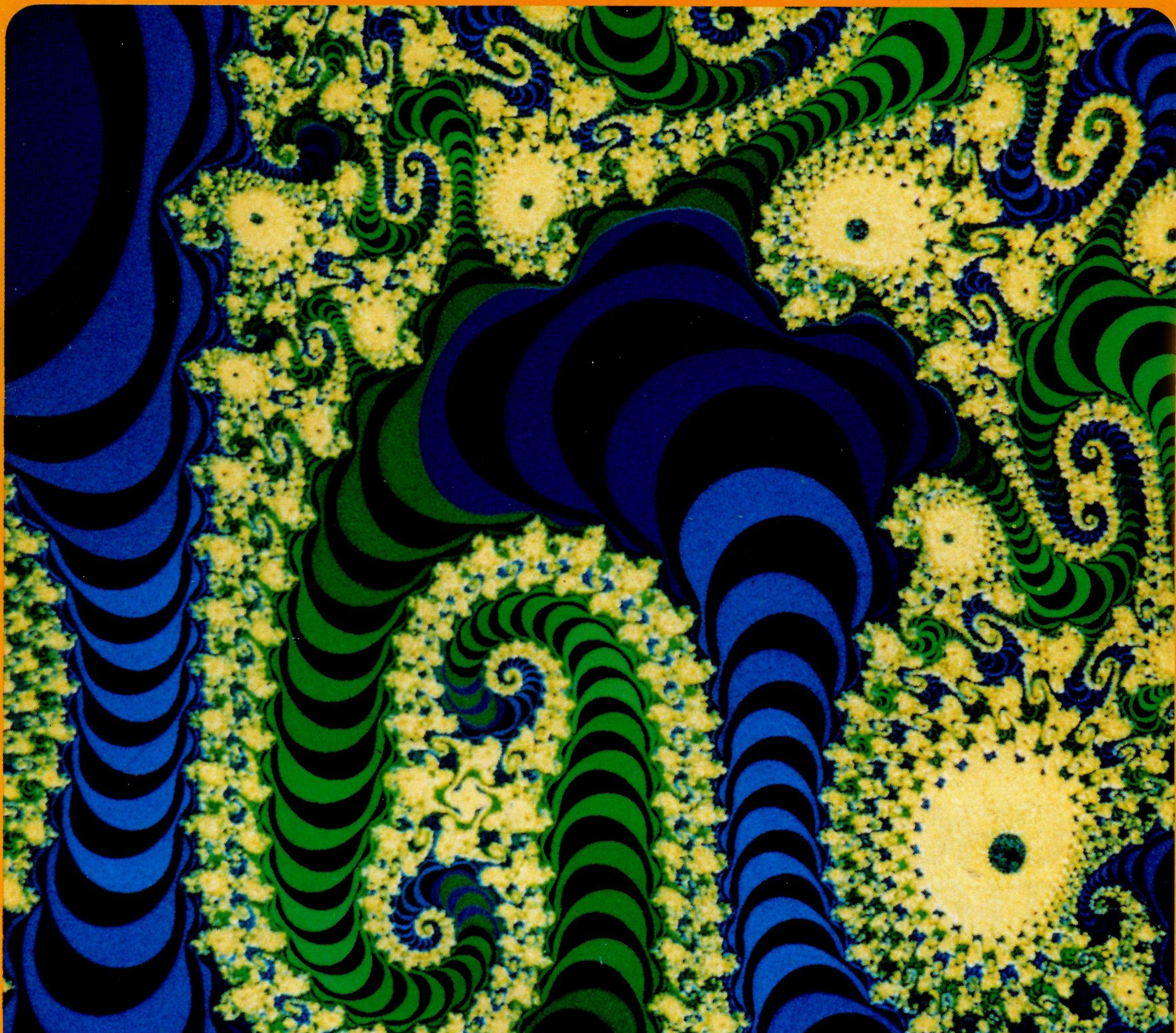
CERN COURIER

International Journal of High Energy Physics



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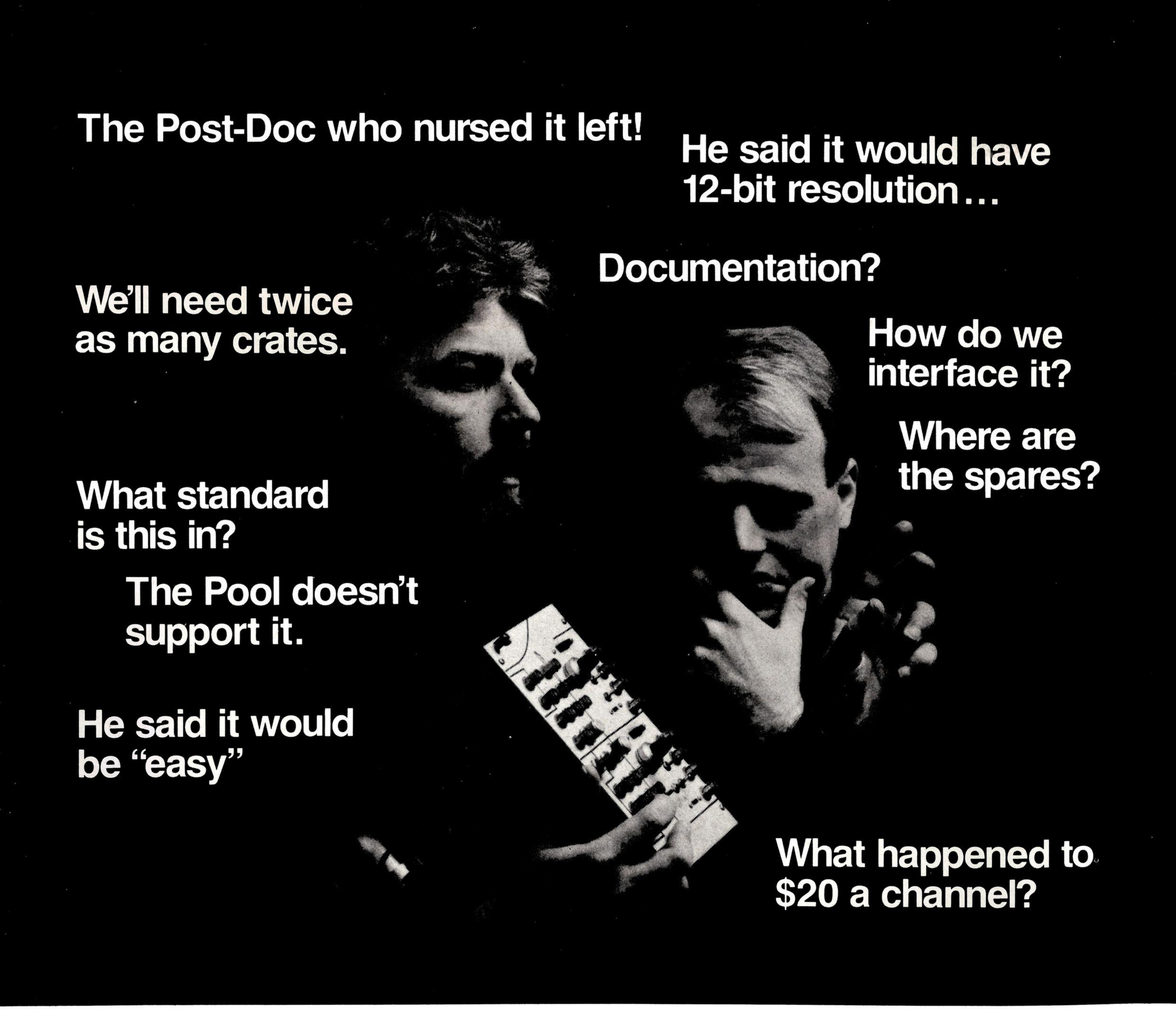

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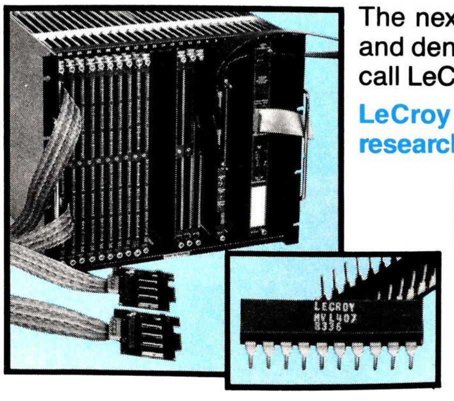

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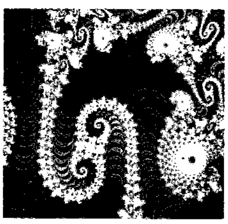
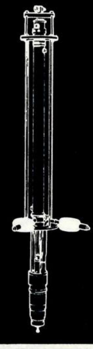
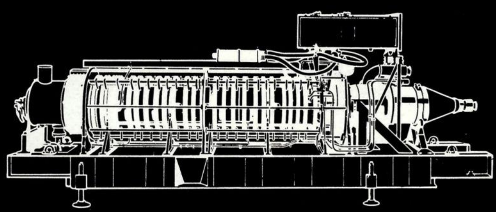
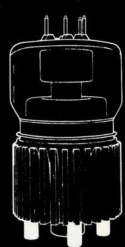


Cover photograph:
Beauty by computer. Using a Megatek colour display, E. John Messersmith, a member of the ALEPH experiment for the LEP electron-positron Collider being built at CERN and working with Sau Lan Wu of Wisconsin at the DESY Laboratory in Hamburg, obtained this fine representation of the Mandelbrot set, generated by the iteration of a complex number function.







Physics in isolation

Berkeley Conference

With some 1600 participants from 45 countries, the 23rd International Conference on High Energy Physics held in Berkeley, California, from 16–23 July was one of the biggest and best organized particle physics meetings ever. Despite the mammoth attendance, there was only a meagre catch of stimulating new results. An exception was the neutrino sector, still controversial after nearly sixty years. With so many physicists busy these days preparing new detectors for high energy machines, a boom of new results when all the new detectors come online should be only round the corner. More ebullient these days is the particle physics/nuclear physics interface, covered at the recent Lake Louise meeting (this page). A report on the Berkeley meeting will feature in our October issue.

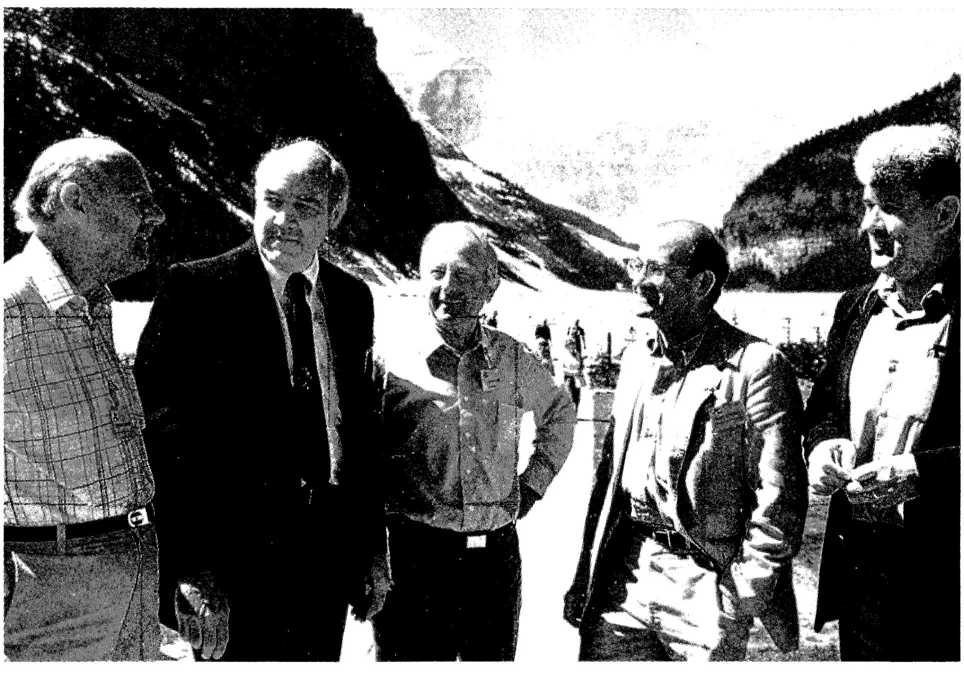
G.F.

In late May, about 330 physicists made their way up to isolated and beautiful Lake Louise high in the Canadian Rockies about 100 miles west of Calgary in a second effort to increase interactions between particle and nuclear physicists. The conference series aims to foster exciting and diverse physics by bringing the different physicists together somewhere which is so isolated that they must interact with each other. The formula worked very well at Steamboat Springs in 1984 (see September 1984 issue, page 283) and the more isolated Lake Louise was a huge success.

Several totally new results were presented, but much of the excitement came from reevaluations of earlier surprising results. In his understated manner Robert Hofstadter concluded, '... we experienced a consolidation and extension of previously known material at this conference.'

The value of the neutrino mass was discussed extensively. New SIN and Los Alamos measurements set upper limits of respectively 18 eV and 25 eV which question the earlier Russian measurement (see June issue, page 15). Suggestions for neutrino oscillations from CERN and from the Bugey reactor were questioned by recent Brookhaven results which appear to exclude most of the Bugey and CERN domain. Hamish Robertson (Los Alamos) concluded: 'There is no non-controversial evidence for non-zero neutrino mass.'

The so-called EMC effect was discussed extensively, especially by E.L. Berger (Argonne) and by R.G. Arnold (SLAC/American University). The earlier results had strongly suggested that quarks in nuclei behave differently than quarks in nucleons. In particular, the quark content of free nucleons and nucleons in nuclei appeared to differ, with the difference depending also on kinematics. The new data show a less marked effect, which is less difficult to understand in terms of conventional nuclear physics.



In the isolation of Lake Louise in the Canadian Rockies, particle and nuclear physicists get together. Left to right Sir Denys Wilkinson (Sussex), Bill Wallenmayer (US Department of Energy), Louis Rosen (Los Alamos), Alan Krisch (Michigan and retiring Chairman of the Organizing Committee) and Erich Vogt (TRIUMF, new Chairman).

Don Perkins of Oxford talks on particle physics away from accelerators.

(Photos Lorne Waldman)

A further talking point was new polarization experiments and the continuing saga of just where perturbative quark field calculations (QCD) are applicable. Thomas Roser (Michigan) reported on the recent successful operation of the Brookhaven polarized proton beam at 22 GeV (see May issue, page 17). This allowed spin experiments at previously unattainable energies by three groups of experimenters. One experiment found that the spin-spin forces in wide angle proton-proton elastic scattering change very rapidly as the polarized beam energy increases. While some theorists had predicted oscillations or decreases, none had predicted a sharp and dramatic decrease. This new spin data added fuel to the lively debate in the lectures by Elliot Leader (Birkbeck College, London), Peter Lepage (Cornell), and Nathan Isgur (Toronto), and by Ed Berger and others in the audience. Opinion was sharply polarized (!), and Elliot Leader declared: 'While many perturbative predictions of polarization effects have not been tested, all those predictions which have been tested disagree with experiment.'

It was clear that much progress must be made before nuclear physics can be understood from quark field theory. The understanding of the nucleon-nucleon force from quark models, discussed by M. Oka (Pennsylvania), is still at a very primitive stage with only the short range repulsion being given by quark models. However, J. Speth (Los Alamos) indicated that even the short range part of the force gives problems since the quark models have trouble reproducing the spin-orbit force needed to fit the data that arises naturally in meson exchange models.

In light nuclei progress is being made both experimentally and theoretically. P. Bosted (American University) reported that measurements of the deuteron magnetic form factor have now been extended. This will put strong constraints on models. The rapid variation of the tensor polarization seen by previous experiments on elastic pion-deuteron scattering now disagrees with three independent measurements by two quite different methods according to G. Smith (TRIUMF); this reduces the need for dibaryons.

For all nuclear systems the need for the relativistic Dirac equation is still being debated (see June 1985 issue, page 183). C. Horowitz (MIT) and J. A. McNeil (Drexel) discussed the so-called Dirac phenomenology which has had much success in proton scattering and has recently resolved discrepancies with the magnetic moments. However, M. Thies (Vrije), pointed out that the successes of the Dirac approach can be reproduced without relativity by the careful treatment of short range effects without introducing the antiparticles.

The evidence for a 'stiff' nuclear equation of state from relativistic heavy ion collisions is growing according to R. Stock (Frankfurt) and J. Harris (Berkeley). This evidence comes from both pion production and information on collective flow. J. S. Greenberg (Yale) and B. Mueller (Frankfurt) discussed the remarkable positron lines seen in heavy ion collisions (see April issue, page 22). While the interpretation is still not certain, the existence of a light particle is not definitely ruled out.

The conference again maintained a uniquely equal balance between particle and nuclear physics. Recently there has been a significant increase in the activity and excitement of particle and nuclear physics in the 1 to 100 GeV range. In the hope that regular meetings contribute to this growth, the organizing committee decided to have a third conference in May 1988. Alan Krisch (Michigan) retired as Chairman and is succeeded by Vice-Chairman Erich Vogt (TRIUMF), while Vernon Hughes (Yale) becomes the new Vice-Chairman. There was much discussion on finding a spot for 1988 which beats Lake Louise for beauty and isolation. This remains a challenge.

Magnets becoming more super

With the twenty year struggle to master superconducting magnets for accelerators behind them, magnet specialists are now very confident of their ability to use superconductivity in accelerator design. Superconductor performance has improved considerably in the past few years and we may well see the number of these magnets escalate from the present figure of about a thousand to over fifteen thousand within the next decade.

This confidence emerged clearly from a recent Workshop at Brookhaven, organized by the Panel on Superconducting Magnets and Cryogenics set up by the International Committee on Future Accelerators (ICFA). It attracted over a hundred people, including experts from China, India, Japan and the Soviet Union, and it was particularly notable that some forty of them were from industry.

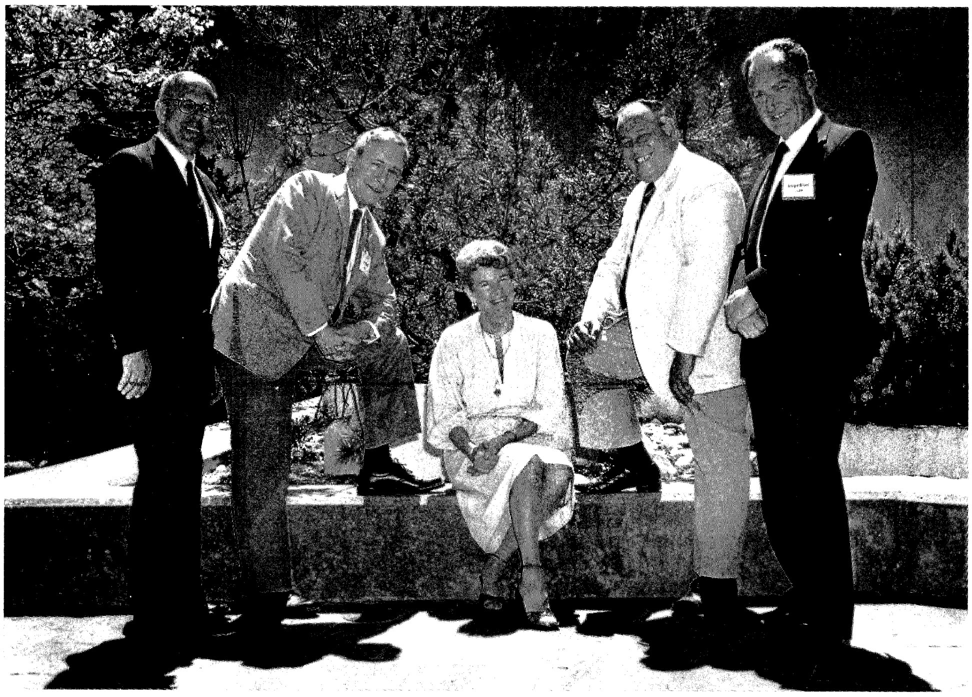
The aim of the Workshop was to take a thorough look at where we are with the design and construction of superconducting magnets for accelerators and at the prospects for future development. Since the Tevatron at Fermilab first operated in 1983, two other big machines are being built with superconducting magnets — HERA at DESY and UNK at Serpukhov — while two others are sufficiently far advanced in the planning stages to be building prototypes — RHIC at Brookhaven and the Superconducting Super Collider, SSC — and still another has such magnets in its conceptual design — LHC at CERN.

Another indication of rapid development is that the design field strengths have moved from around 4 T in the Tevatron to as high as 10 T in the LHC design. In recent years, improvements in the quality of the superconducting cables available from several companies in industry enables some 50 per cent more current density to be passed through the cables. The SSC bending magnet field, for example, is now quoted as 6.6 T rather than 6 T because of cable improvements since the machine design was started.

These advances have been with the standard niobium-titanium superconductor. More can be hoped for from niobium-tin or niobium-aluminium, whose development is being pushed particularly by the needs of the LHC design, but practical demonstration of their potential is far less plentiful. The recent meeting at the Rutherford-Appleton Laboratory (see July/August issue, page 25) should help to push collaboration on their development.

Nevertheless the consensus at the Workshop was that 10 T is now achievable either through operating niobium-titanium magnets at a lower temperature (about 2 K) or by using niobium-tin or niobium-aluminium. 10 T is probably the limit with presently known technologies partly because the materials used would not stand much greater mechanical forces than they experience at these field levels.

Designs of high field magnets seem to have standardized in using two concentric collared coils and a cold iron yoke. For colliding beam systems, however, there is still contention between schemes using two separate magnet rings like the SSC and schemes using a single ring with 'two-in-one' magnets like the LHC. The design of large-scale



The workers behind the Workshop. Pictured during the ICFA meeting on superconducting magnets at Brookhaven are, left to right, Art Greene, who chaired the local organizing Committee, scientific secretary Pat Tutle, Workshop secretary Per Dahl, Paul Reardon, who chairs the US delegation to the ICFA Panel, and Giorgio Brianti, the Chairman of the ICFA Panel.

cryogenic systems has benefited greatly from the experience at the Tevatron. With the desire to reach higher fields while perhaps still using the standard niobium-titanium cables, there is more effort on operating such systems at lower temperatures. The 1.8 K system pioneered in France for the Toresupra Tokamak has given encouraging results.

During the Workshop the ICFA Panel decided to appoint a subpanel to recommend standards for specifying and measuring superconducting wires and cables. If such standards can be agreed they should help both Laboratories and industry.

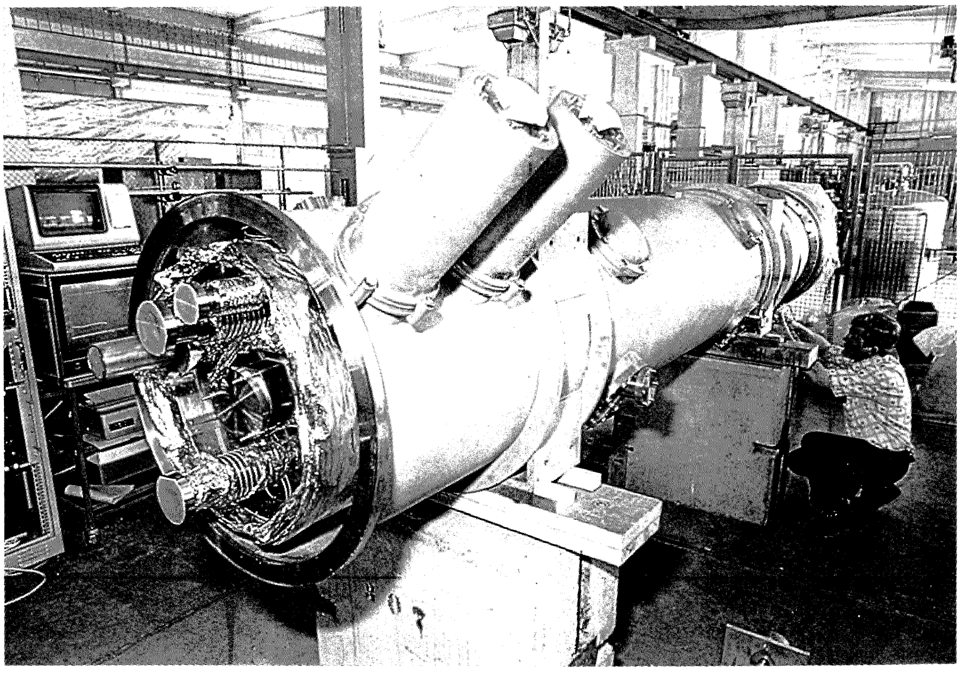
The whole field of superconducting magnets and cryogenics seems to be in a very healthy state and is still developing fast. It was impressive at the Workshop to have many excellent contributions from industry because, although the field is being driven by the requirements of particle physics, there are many important spinoffs of this technology in other fields. Applications are already clear in nuclear magnetic resonance, thermonuclear fusion, and the electrical industry.

Cold under the collar

The team working on the proton ring magnets for the HERA electron-proton collider at DESY have made an important contribution to the present state of euphoria on superconducting magnets. Coming in the wake of the many years of work on the magnets for the Tevatron at Fermilab and Isabelle at Brookhaven, they emerged with what they initially called the 'hybrid' magnet which built on Fermilab's coil configuration and collaring and Brookhaven's cold iron completely immersed in a cryostat. This style of magnet now seems to be favoured almost everywhere.

Recent prototypes tested at DESY are exceeding the design fields of 4.6 T with excellent field quality. Much of this has come from cable improvements which now allow 8800 A per cm^2 compared to the requested 6500 A. Heat losses in the prototypes are still a bit high and it is hoped to improve their performance by a factor of three.

DESY are also pioneering large scale manufacture of superconducting magnets in industry with production in Italy and in Germany. Ten pre-series magnets will be produced to iron out any last details before launching into full production.



The first prototype quadrupole magnet made at Saclay for the HERA electron-proton collider now under construction at DESY in Hamburg has arrived at its destination.

Probing the Pomeron

High energy elastic scattering — when two incident particles interacting through the strong nuclear force 'bounce' off each other and emerge apparently intact — is understood by the transfer of a 'Pomeron' between the colliding particles (Soviet physicist Y. Pomeranchuk developed important theorems about high energy scattering). As well as mediating elastic scattering, the Pomeron can also drive inelastic 'diffractive' reactions which produce fast forward particles. It is the Pomeron which transmits the 'force' of diffraction.

Despite physicists' easy familiarity with the Pomeron, its real nature remains very much a mystery. However a number of clues have been found recently which provide important new insights.

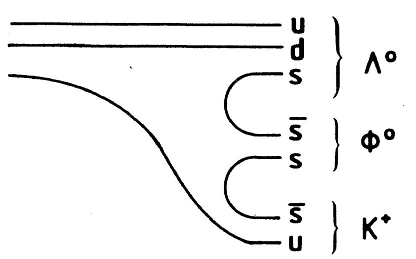
Although CERN's Intersecting Storage Rings (ISR) were closed two years ago, pearls are still turning up in the wealth of accumulated data. The R608 collaboration looked for examples of proton-proton collisions giving diffractive production of groups of particles with interesting quantum numbers.

These particles emerge along the proton beam direction, carrying almost all the available momentum, and can be looked at as the results of a 'collision' between a proton and a Pomeron.

Further information comes from looking at the kinematics of the produced particles within the forward-moving system. This shows that particles containing valence quarks inherited from the proton zoom off in the forward and/or backward directions, while on the other hand particles such as the phi meson (strange quark-antiquark) which do not include proton valence quarks stay behind in the middle.

This suggests that the Pomeron interacts not with the proton as a whole, but rather with one of its individual quark constituents. (This was hinted at by the so-called additive quark rule, where total reaction rates (cross-sections) could be estimated by counting the number of valence quarks and antiquarks in the colliding particles.)

Interactions with individual quarks are well known in electromagnetic interactions such as electron-proton scattering, where the force is transferred by a (virtual) photon.



What happens when one of the three 'valence' quarks (in this case a u) in a proton gets 'kicked' by a Pomeron in diffractive scattering.

If the Pomeron does behave like a photon, elastic proton-proton scattering can be calculated under certain conditions (small momentum transfer) in terms of measurements (form factors) from elastic electron-proton scattering. The precision elastic scattering data from the ISR, and now also from the CERN proton-antiproton Collider, are in good agreement with these calculations, and the picture has also been extended to include inelastic diffractive production of particles.

However the Pomeron is essentially a strong nuclear interaction, and as suggested by F. Low and S. Nussinov could correspond to the exchange of a number of gluons — the carriers of the inter-quark force. To get the quantum numbers right at least two gluons are required, which perhaps makes it surprising that the Pomeron appears to couple to one quark at a time. P. Landshoff and A. Donnachie have developed a picture of the Pomeron at large momentum transfer in terms of the exchange of three gluons.

An important feature of proton-proton elastic scattering is the way it first dips and then rises with increasing momentum transfer. This could be due to interference between two types of behaviour which dominate in different kinematic (momentum transfer) regimes. Right at the end of its life, the ISR provided a brief but valuable glimpse at proton-antiproton elastic scattering under the same conditions. This shows a 'shoulder rather than a dip. For proton-antiproton scattering, the sign of the three gluon contribution changes sign, offering one explanation. There are others on the market.

Models of the Pomeron must also account for the dramatic rise (more than an order of magnitude) between the proton-antiproton elastic scattering behaviour between ISR and CERN Collider energies.

Another example of Pomerons at work in high energy proton-proton scattering is when the two protons fly out relatively undeflected, but leave in their wake a central cluster of produced particles.

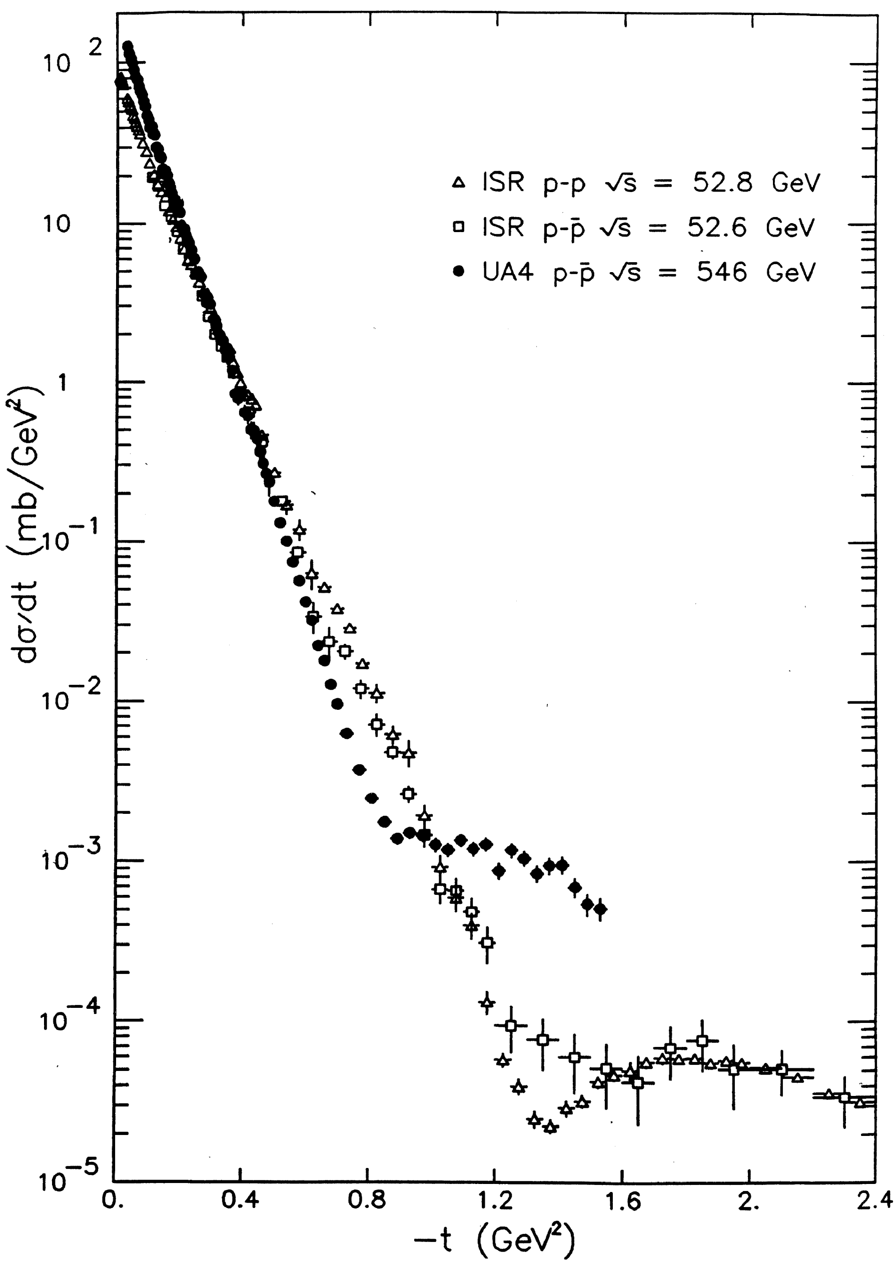
This central cluster can be understood as resulting from the 'collision' of two Pomerons, one coming from each of the incoming protons, and can be thought of as a (virtual) particle state potentially present in the vacuum being kicked into reality by the passage of the two glancing protons, which provide the necessary energy.

Such reactions have been studied by the R419 experiment which used the Split Field Magnet at the ISR. This hints at the possible quark and gluon content of the Pomeron, and how its behaviour changes with kinematical conditions.

Another ISR experiment, the Axial Field Spectrometer, has made a systematic study of these double Pomeron interactions, searching for signs of new particles, including 'glueballs' — states made of gluons rather than quarks. The UA1 experiment at CERN's proton-antiproton Collider has also begun to look at these double Pomeron interactions.

Also at the CERN Collider, the UA8 experiment (see July/August 1985 issue, page 237) is searching for clusters of produced particles ('jets') in inelastic diffractive collisions. Here an ingenious new computer with data flow architecture calculates the recoil proton momentum between successive proton-antiproton bunch crossings.

(From M. Albrow, A. Donnachie, W. Geist, P. Landshoff, P. Schlein)



What makes proton-proton and proton-antiproton scattering so different? The marked diffractive dip seen in proton-proton elastic scattering at the Intersecting Storage Rings (ISR) becomes a gentle 'shoulder' in the proton-antiproton case. This shoulder also lifts dramatically at the higher energies (UA4) of the CERN proton-antiproton Collider.

Around the Laboratories

GRENOBLE
Synchrotron radiation for Europe

The provisional Steering Committee of the European Synchrotron Radiation Facility (ESRF), on which France, the Federal Republic of Germany, Italy, Spain and the United Kingdom are represented, has begun work on preconstruction studies for an X-ray source. Senior staff were appointed in February.

Ruprecht Haensel, Director of the Institut Laue-Langevin in Grenoble and who played a pioneer role in setting up the synchrotron radiation laboratory at DESY in Hamburg, has been appointed Director General of the project.

Jean-Louis Laclare, who will assist him as head of the project group, is head of the theory group at the Saturne National Laboratory at Saclay, where he initially helped design the Saturne accelerator and was subsequently in charge of the construction of the Mimas injector.

Gottfried Mülhaupt, assistant head of the project group, comes from the Free University of Berlin. He participated in the construction of the DORIS storage ring at DESY and has been in charge of the BESSY source at Berlin since 1978.

Andrew Miller, first director of the European Molecular Biology Laboratory outstation at Grenoble (1975-80), and professor of biochemistry at Edinburgh, will be Director of Research.

Giorgio Margaritondo will also be Director of Research. He has been associate director of research at the Wisconsin synchrotron radiation source.

Senior staff for the proposed European Synchrotron Radiation Facility for which preconstruction studies have begun at Grenoble, France. Left to right Administration Head N. Lawrence, Project Director J.-L. Laclare, Director General R. Haensel, Research Director A. Miller, Co-director G. Mülhaupt. Research Director G. Margaritondo is not on the photograph.

DESY
Hi H1

Detailed plans are now tabled for two large detectors to explore the unique physics which will be opened up by the HERA electron-proton collider being built at the German DESY Laboratory in Hamburg.

The ZEUS detector was described in a previous article (see July/August issue, page 16). This time the spotlight falls on the H1 detector.

Colliding 820 GeV protons with 30 GeV electrons in HERA will probe the structure of matter down to an unprecedented precision of 10^{-18} cm.

High energy colliding beam machines have so far concentrated their activities on handling similar particles (particle-particle or particle-antiparticle), giving symmetric collision conditions. In HERA, this will no longer be the case, and most of the produced particles will emerge in a narrow cone around the proton direction leading a rather asymmetric detector design.

To look for signs of new physics, the detector must be able to intercept information from all collision products, including neutrinos and other particles which interact little with matter.

Excellent energy flow measurement together with fine granularity, accurate energy measurement and very good absolute energy calibration are all vital. In addition, electrons and muons will play a key role.

Calorimetry for H1 is based on the liquid argon technique because it provides good linearity and long term stability. It also allows fine granularity and easy intercalibration between different calorimeter segments. Electromagnetic and hadronic stacks cover the forward and barrel region within a huge single cryostat.

Another unusual feature is the decision to place the H1 magnet outside most of the apparatus. In the majority of collider detectors, the magnet surrounds the central particle tracker, but inside the calorimeters which measure the energy deposited by emerging particles. The H1 magnet will instead surround all the apparatus except for the instrumented iron yoke and the outer muon detectors. It will thus be large — 6 m diameter — providing a central field of 1.2 tesla.

This solution will ensure a strong and homogeneous magnetic field for particle tracking in the central region of the detector, minimizing the amount of inert material in front of the electromagnetic calorimeter and providing a large field volume for the liquid argon calorimeters, giving an additional lever on muon measurements.

Because of the intrinsic asymmetry of the electron-proton collisions the main tracker will be composed of a large cylindrical central drift (jet) chamber (outer radius 80 cm, length 264 cm), together with an array of drift chambers, interleaved with wire chambers and transition radiators, to handle the difficult pattern recognition problems in the forward (proton) direction. Additional chambers inside and outside the central jet chamber will improve measurements of the z-coordinate along the beam direction.

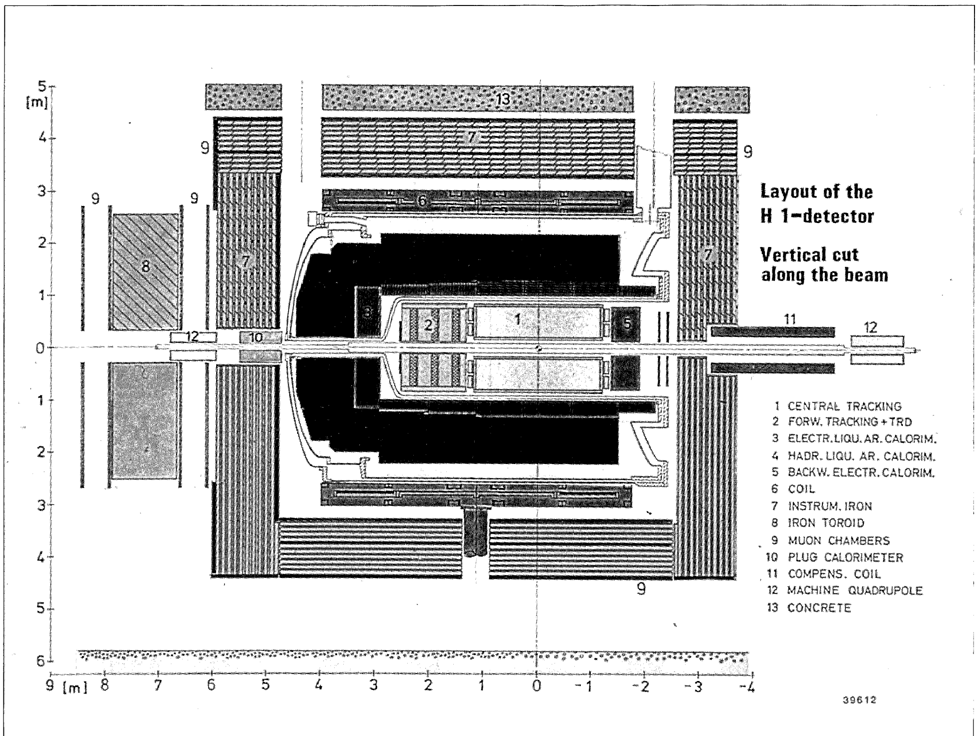
Surrounding this tracking instrumentation will be the calorimeters to measure deposition of electromagnetic and hadronic energy. The electromagnetic section will use lead plates and liquid argon in the 'barrel' and forward directions, while a 'plug' of lead-scintillator sandwich in the backward direction will complete electron measurements.

The hadron calorimeter (barrel and forward directions only) will be made of stainless steel absorber plates with liquid argon as the active medium. A weighting procedure based on the fine longitudinal and transverse segmentation of the calorimeter will be used to balance the hadronic and electromagnetic signals.

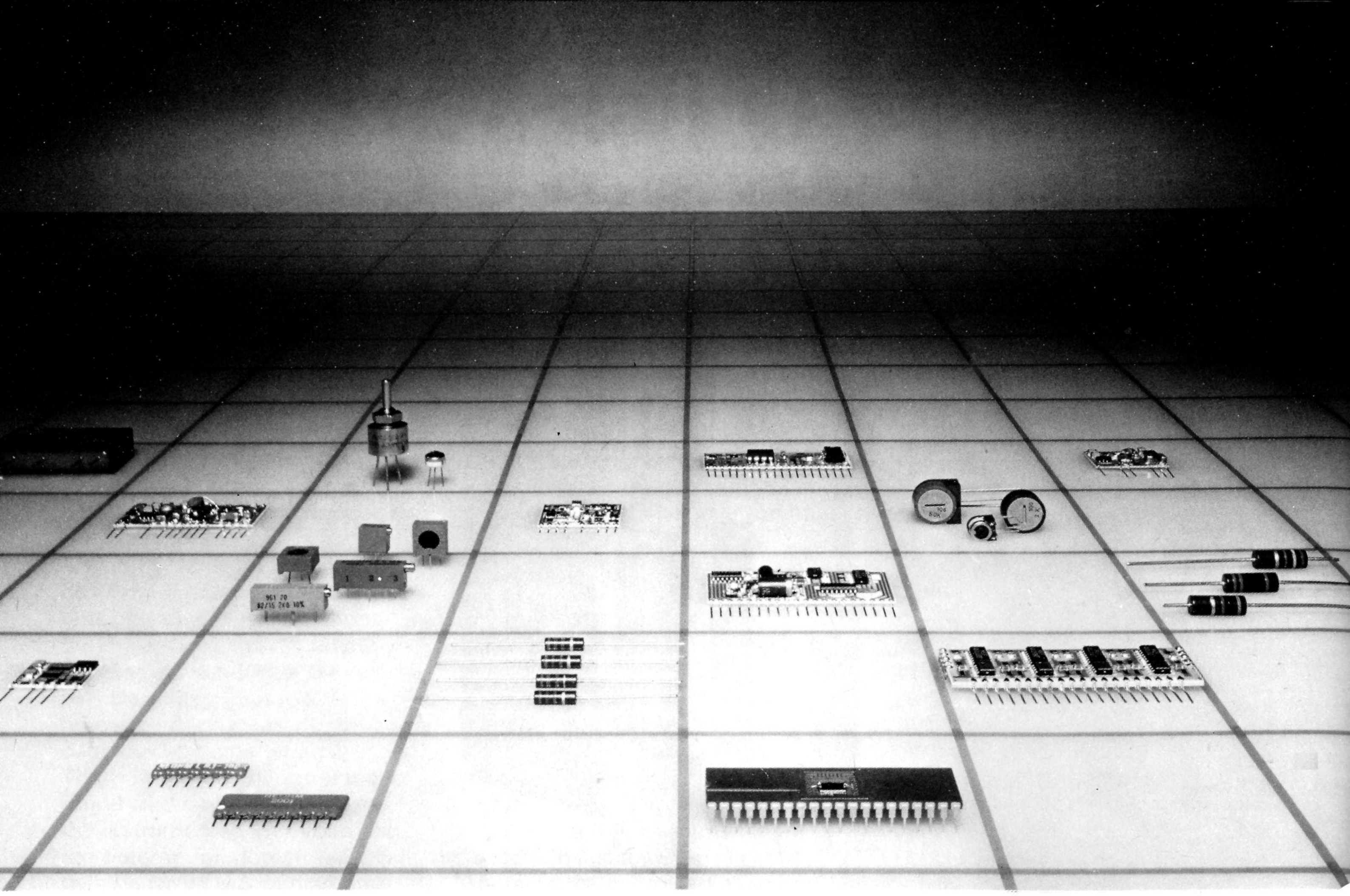
The superconducting coil surrounds the calorimeter, with the outer iron intercepting any remaining hadrons. Interleaved with plastic streamer tubes, this iron will also track the emerging muons. Further muon detection will be provided by chambers in the barrel and forward directions, complemented by a forward muon spectrometer consisting of a magnetized iron toroid with layers of drift chambers.

A small copper-silicon sandwich 'plug' calorimeter around the beam will intercept particles emerging in the extreme forward direction down to 0.7 degrees.

The 170 H1 physicists, from 24 research institutes in 8 countries, will be well equipped to explore the new outlook on physics which HERA will provide. Their detector should be complete early in 1990 when HERA is expected to start operation.



Layout of the proposed H1 detector for the HERA electron-proton Collider at DESY.

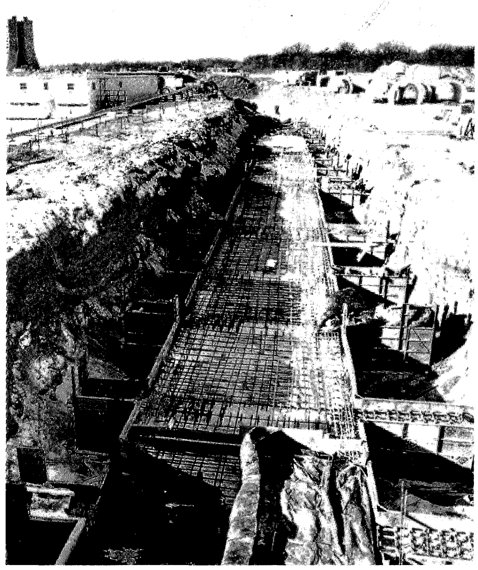


An overpass was required to take the Fermilab Tevatron over the big new Collider Detector.

FERMILAB Overpass

One of the critical projects at Fermilab during the winter shutdown was the installation of the main ring bypass over the Collider Detector. This bypass takes the old main ring more than 21 feet above the plane of the Tevatron to soar over the gigantic detector. Installation involved the excavation and removal of approximately eighty ten-foot main ring sections buried more than fifteen years ago. A new two-storey tunnel was installed to accommodate the arching accelerator. Digging got underway in late October (1). By Christmas the old tunnel sections had been removed and placed to the side and the first floor gallery construction completed (2). In mid-January the old tunnel sections were being put in place to form the second storey in the tunnel (3). By late January the second storey was taking shape. The lower part of the tunnel was occupied in early May and installation of the Tevatron began.

1 — digging starts



2 — first floor complete

3 — old tunnel sections make up the second floor

4 — second floor takes shape

Spin surprises

The spin direction (polarization) of produced hyperons is a talking point whenever spin physics is discussed.

Recently-published results of polarization measurements at Fermilab confirmed some expectations but also produced some surprises. Over the past decade measurements have shown that hyperons produced by protons are substantially polarized. This result has provoked discussions by theorists and models predict equal polarizations of lambdas produced by protons (about 10 per cent) and antilambdas produced by antiprotons. They also predicted that lambdas produced by negative kaons will have polarization equal but opposite to that of lambdas produced by protons.

A collaboration involving the University of California (Davis and San Diego), Carleton, and Michigan State has performed polarization measurements at Fermilab to check these predictions. Comparisons of the polarization of lambdas (antilambdas) from protons (antiprotons) were in good agreement with the predictions. The surprise came with the polarization of lambdas produced by kaons. While of the predicted sign, it was well in excess (60 per cent).

CERN
Rubbia Committee recommends increased research and development

Presenting an interim report of the Long Range Planning Committee set up by CERN Council in June 1985, Chairman Carlo Rubbia advocated that to safeguard its future CERN should increase its commitment for research and development work.

The Long Range Planning Committee has as its mandate 'to explore various options for the long range future of CERN, taking into account existing facilities, emphasizing respective pros and cons; in working out these options, realistic boundary conditions concerning financial and manpower limitations should be taken into account'.

Its members are G. Brianti (CERN), P. Darriulat (CERN), G. Ekspong (Stockholm), C. Rubbia (CERN), A. Salam (Treiste and London), S. van der Meer (CERN), S. Ting (MIT) and G. Voss (DESY).

The Committee set up three specialist subpanels: one, chaired by G. Brianti, to look into the feasibility of a hadron collider in the LEP tunnel (see June issue, page 5); a second, chaired by K. Johnsen, to investigate the possibility of a large electron-positron collider in the 1000 GeV range; and a physics subpanel chaired by J. Mulvey to look into the underlying physics issues.

To drive forward the twin spearheads of a hadron collider in the LEP tunnel and a 1000 GeV electron-positron collider, the Committee advocates that a 'vigorous programme of research and development in advanced accelerator technology be immediately undertaken in collaboration with outside Laboratories and with industry. This work should concentrate on the development of higher field superconducting magnets, pushing fields towards the range 8-10 tesla, which appear to be attainable provided a vigorous European R and D programme for superconductors, cryogenics and magnet design and construction is launched now'. Likewise to push the electron-positron collider option along, a dedicated team should be set up 'in order to make valid judgments on the various possibilities and to create a solid basis for future decisions'.

The Committee points out that there are still questions which need to be further explored before any final recommendations can be made, but the viewpoint on its broad outlines is 'not likely to change'.

Carlo Rubbia — long term future of CERN.

CERN
Heavy hypernuclei at LEAR

The decay of lambda hypernuclei (nuclei in which a lambda hyperon has replaced a nucleon) enable physicists to learn how the decay properties of a hyperon change in nuclear matter.

Until now kaon beams have usually been used to produce these hypernuclei and the heaviest hypernucleus reached this way was of carbon 12. The aim of an Amsterdam/CERN/Darmstadt/Grenoble/Orsay/Sarclay/Uppsala/Warsaw collaboration is to take advantage of the high quality of the low energy antiproton beam of CERN's LEAR ring to produce much heavier hypernuclei and to measure their lifetime. It was expected that lambda hyperons could appear in the annihilation of antiprotons in heavy targets like uranium.

The energy released in the decay of these hypernuclei is about 160 MeV which may induce the fission of residual nuclei. This fission is delayed by the lifetime of the hypernuclei in contrast to prompt

Minister Mustafa Tinaz Titiz (left) from Turkey is greeted by Ambassador Alfonso de la Serna from Spain when he attended the June Session of the CERN Council. In the background are the Swiss delegate to Council Jaques Vernet (left) and the Turkish Ambassador E. Yavuzalp. The Minister made a statement in which he said that Turkey 'will try to benefit from the experience and research at CERN... During the transitory phase lying ahead, my country will enjoy increasing cooperation and assistance from the Organization'. It is expected that discussions will be initiated soon with a view to Turkey becoming a Member State of the Organization.

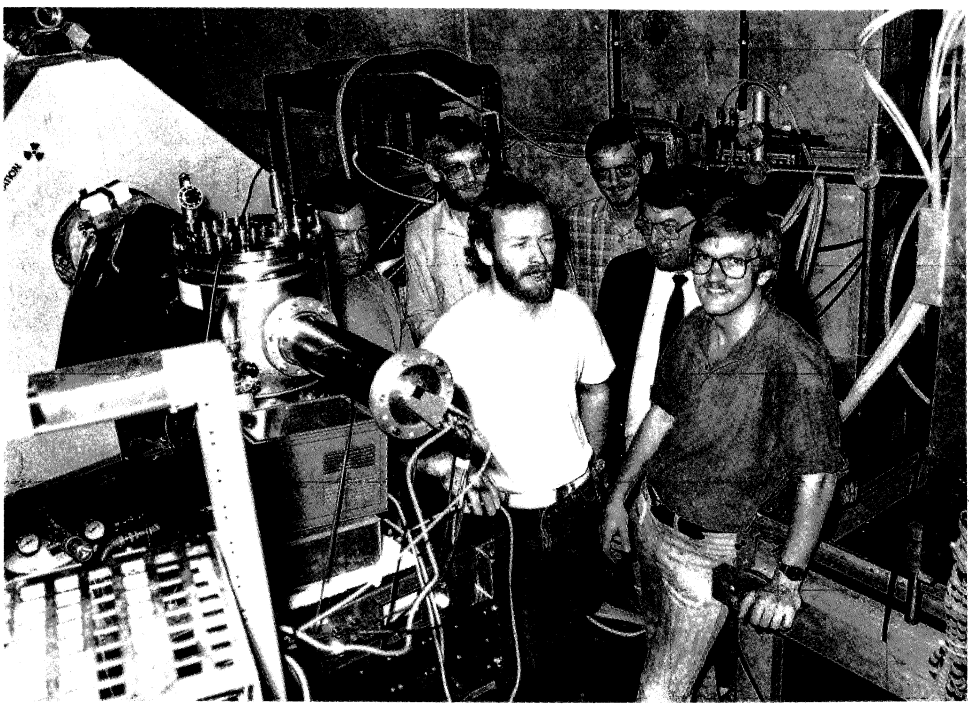
(Photo CERN 864.06.86)

fission which results directly from the annihilation of antiprotons and which occurs much more frequently. The experimental method is based on the so-called 'recoil-distance technique' developed by a Copenhagen-Heidelberg collaboration to measure the lifetime of fission isomers from the distance travelled by the nucleus before it decays.

The experiment at LEAR shows that for almost every thousand antiprotons brought to rest in the uranium target, one delayed event is observed. The experimenters are led to conclude that they are observing delayed fission due to the decay of hypernuclei of thorium and neighbouring elements. Preliminary estimates of their lifetime give a value close to 10^{-10} s, which is somewhat shorter than for lighter hypernuclei like carbon 12. The experiment is continuing.

Ionization surprise

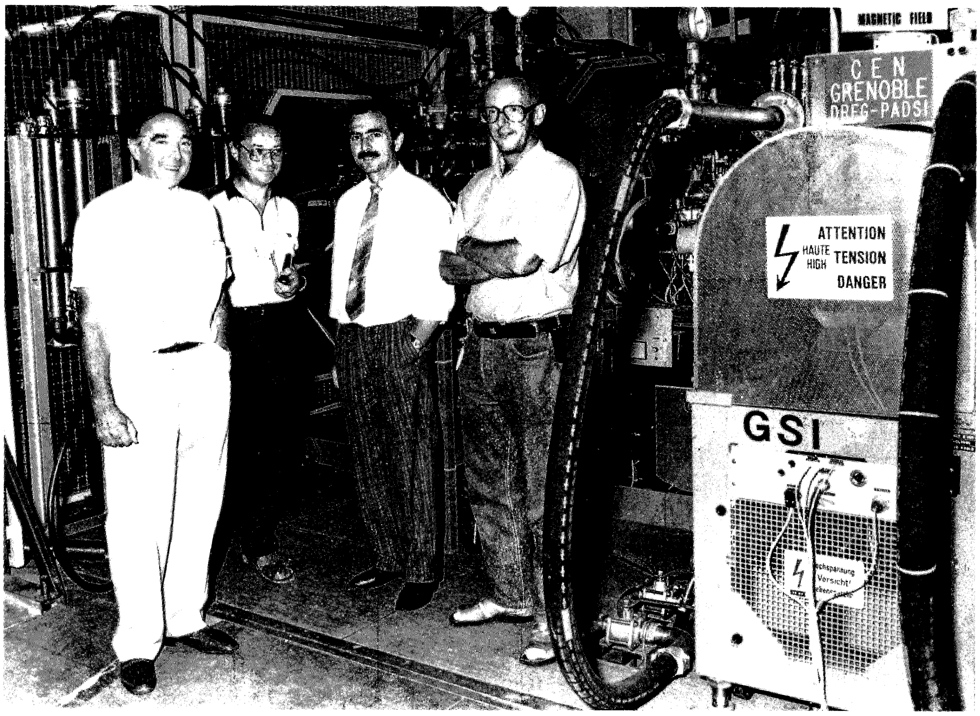
Also at CERN's LEAR Low Energy Antiproton Ring, a pocket-sized experiment by an Aarhus/CERN team has found that 100 MeV/c antiprotons are much more effective than protons in ripping out both electrons from atoms of helium gas. The availability of intense beams of antiprotons at CERN shows that atomic physics is far from being a closed book.



Members of the Aarhus/CERN group with their modest apparatus which found surprising ionization effects in helium gas using antiprotons from CERN's LEAR Low Energy Antiproton Ring.

Wrought ions

After overcoming some initial difficult problems with linac breakdown, the ion acceleration tests at CERN are going well. At the time of writing, oxygen ions have been accelerated in two of the Booster rings and fed to the PS. There they have been taken to 160 GeV thus exceeding the previous energy record for oxygen ions of 57 GeV in the Berkeley Bevatron. The PS could have nudged the energy a little higher but this is the role of the SPS which wants to receive ions at 160 GeV. The first injection tests into the SPS are scheduled for September and it is hoped to have three weeks of physics at high ion energies before the end of the year.



Some of the men behind the successful supply of oxygen ions using CERN's 'old' Linac 1 line up in front of the radiofrequency quadrupole supplied for the project by Berkeley. On the right is the ion source supplied by Grenoble with funding from GSI Darmstadt. Left to right, R. Geller (Grenoble), Charles Hill (CERN), Norbert Angert (GSI Darmstadt), Helmut Haseroth (CERN).

(Photo CERN 9.8.86)

Back to the source

With the hard-won successes of the ion injector, experimenters at CERN hope that they are en route for the quark-gluon plasma. Many developments have contributed to this optimism since the idea of using oxygen ions from the CERN accelerators was first made public by the Berkeley/CERN/GSI (Darmstadt) collaboration in 1982. A vital one was the development of an adequate ion source.

The source, given the name MINIMAFIOS (MINIMAchine à Faisceaux IOniques Strippés, has been developed at the Institut de Recherches Fondamentales at Grenoble. It has to provide comparatively high intensity (80 microamp) beams of oxygen 6+ions of good quality which is crucial for the CERN machines which need at least 10 microamps for their monitoring and control systems. Even when the ions from the source have been taken to an energy of 12.5 MeV per nucleon in the first linac tank and then fully stripped, there still remains a 10 microamp ion beam for the synchrotrons to handle.

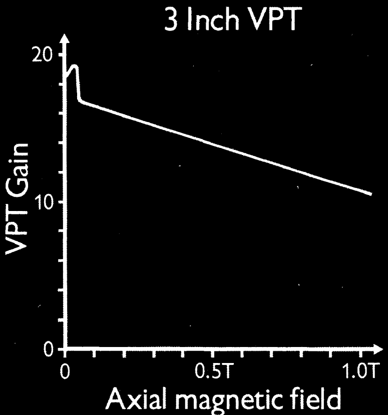
Previously available sources would have required a cyclotron to accelerate e.g. oxygen 3+ions and then fully stripping them prior to injection in the CERN machines. The complexity and cost of such an installation would almost certainly have killed the project.

The source is of the ECR (Electron Cyclotron Resonance) type which is now used at a number of Laboratories. It essentially involves a cylinder of rarified gas (oxygen in the case of MINIMAFIOS) which is subjected to short pulses of 10 GHz radiation. A special magnetic field configuration confines the plasma which is created so that the liberated electrons which are at about 1 keV can resonate. The successive collisions in the gas liberate a high number of ions which can be extracted from the source in the conventional way.

Since April of last year MINIMAFIOS has been exceeding its design requirement providing good quality beams of over 100 microamps of oxygen 6+ions. This has been an important factor in realizing accelerated beam intensities beyond the specified intensity (peak 34 microamps from the Linac rather than 10) so soon after start of the tests at CERN.

ONE T?

The OPAL and DELPHI end-cap calorimeters at CERN require lead-glass arrays to be read out in full axial fields up to 1.2 tesla. Not a task for conventional PMTs. So, building on our experience in vacuum photo diodes, we developed a family of Vacuum Photo Triodes to do the job. In 1½", 2" and 3" sizes, and with low capacitance to minimize contribution to preamplifier noise. With gains ≈10 at 1 T axial. Even at 20° from axial, gains still high enough to lift the signal well clear of preamplifier noise. We're prepared to discuss versions for fields up to 70° from axial.



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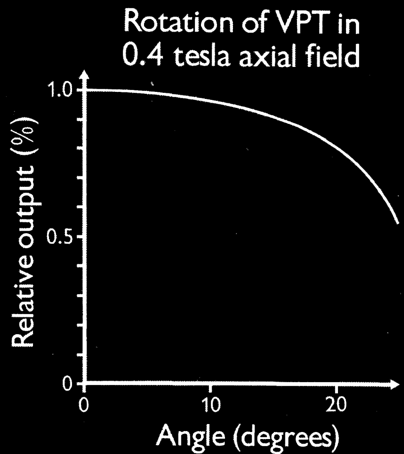

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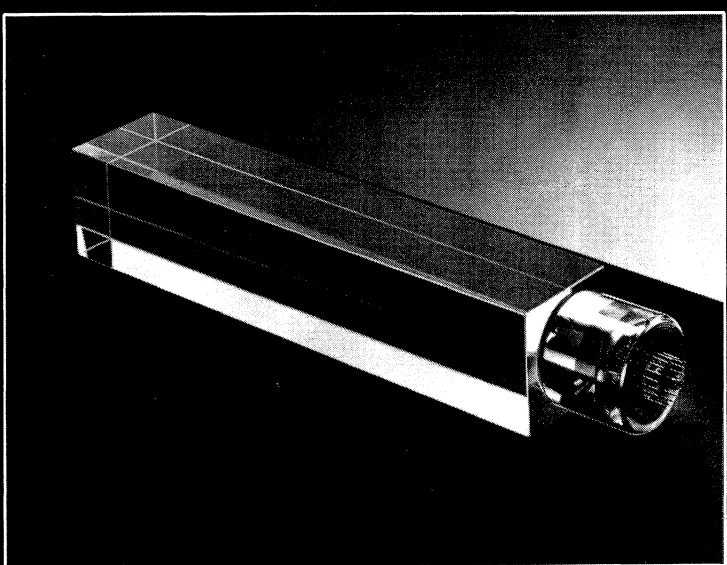

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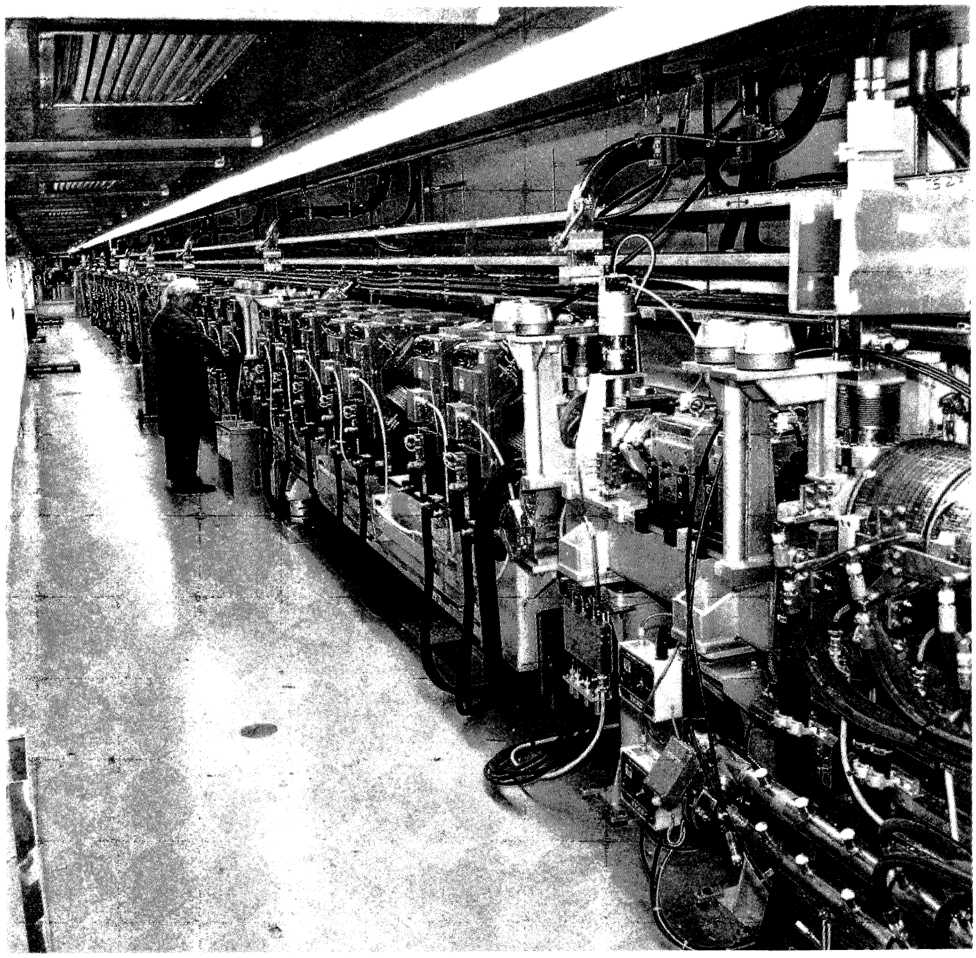
The LEP Injector Linac (LIL) has produced its first electron beams.

(Photo CERN 514.2.86)



Another step towards LEP

In June, beams for CERN's LEP electron-positron collider took another step forwards when 400 MeV electrons were produced in the LEP Injector Linac (LIL) and went on to circulate happily in the Electron-Positron Accumulator (EPA). Electron beam is now knocking on the door of the 'Proton' Synchrotron, and the aim is to inject into the PS soon. Once the electrons have blazed a trail, the positrons will follow. Injection into the 7 kilometre SPS ring, the last stage of the LEP injection system, is scheduled for next year.

CERN School of physics

This year's CERN School of Physics, the 25th, was held from 8-21 June in Sandhamn, near Stockholm. This exotic island in the Stockholm archipelago helped create a friendly atmosphere for the 80 very ambitious students (coming from 20 different countries) and their 20 or so lecturers and discussion leaders.

The first week was devoted to introductory courses including field theory by S. Rudaz, quark dynam-

Cecilia Jarlskog rings for attention at this year's CERN School of Physics, held in June on the Swedish island of Sandhamn.

(Photo W. O. Lock)

ics by P.V. Landshoff and experimental tests of gauge theories by K. Kleinknecht. In addition, more advanced material was presented by J. Ellis (superphysics) and G. 't Hooft (quantum black holes). The subjects of the second week were physics at LEP presented by R. Peccei and proton-antiproton collider physics reviewed by D. Dau. Swedish activities in particle physics were presented by C. Jarlskog and P.O. Hulth. G. Ekspong gave an appreciated talk on the discoveries of various chemical elements. To the surprise of many quite a few elements turned out to have been discovered in the immediate vicinity of the School, especially in the Ytterby mine on a nearby island. As usual, the poster session was considered by many as one of the highlights of the School.

The students presented an impressive amount of work as witnessed by the many excellent and informative posters on display. During the School, there was always a fruitful dialogue between students and lecturers in the informal atmosphere created.

In accordance with tradition, the Proceedings of the School will be published by CERN as a Yellow Report in the near future. Sponsors of the School included, besides CERN, the University of Stockholm, the Swedish Ministry of Education, the Nobel prize committee for physics, the Wenner-Gren foundation and the Swedish Natural Science Research Council.

From Lars Bergström and Per Olof Hulth

Holland at CERN

Hot on the heels of the French (see May issue, page 6) came the Dutch with their 'Holland at CERN' show, the 25th in the series of industrial exhibitions which are now a well-established feature at CERN. The official opening ceremony on 3 June gave CERN Director General Herwig Schopper the opportunity to welcome the Dutch to CERN for their first exhibition and underline the usefulness of such exhibitions for strengthened relations between CERN and national industry.

One feature of CERN's relations with industry is the absence of quotas for Member States. This makes for healthy industrial competition.

Dutch Minister of Economic Affairs C.A.P. Vermeulen said how tempting it was for Dutch industry to come to CERN to meet the research world. He saw science and research as a source of inspiration and an innovating power in society which can break down international barriers.

Minister for Education and Science P. van't Klooster placed CERN at the leading edge of modern technological development. He maintained that open competition is a must to encourage development.

The 'Holland at CERN' exhibition was organized by the Dutch Association of the Mechanical and Electrical Engineering Industries (FME) in co-operation with Dutch Scientific. The exhibition brought together representatives from some forty firms. Great Britain takes the baton for the next in this run of exhibitions at the end of September.

Introducing the 'Holland at CERN' exhibition in June: CERN Director General Herwig Schopper (left) with Dutch Minister of Economic Affairs C.A.P. Vermeulen.

(Photo CERN 120.6.86)

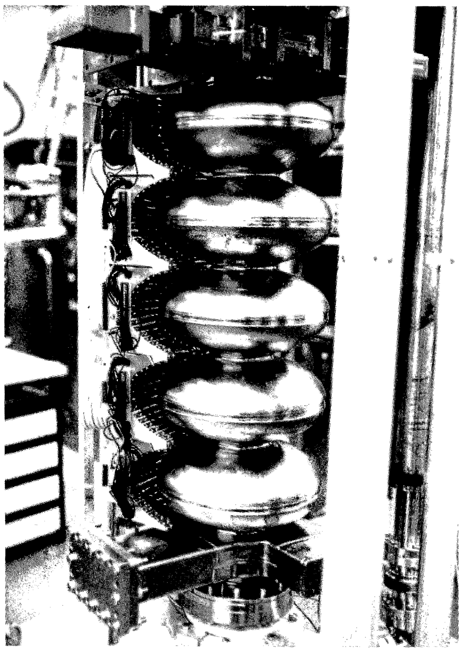
Thinking straight

Two thousand five hundred linear accelerators are now estimated to be in use throughout the world. Of these a negligible number are on particle physics machines; yet they have all stemmed from the technology developed to do particle physics.

This figure was quoted at the 1986 Linear Accelerator Conference which drew 300 linac specialists to Stanford in June for a meeting excellently organized under Greg Loew. A new Conference technique was tried very effectively — strings of five-minute talks with no subsequent discussions. It seems that the five minute allocation concentrates the mind wonderfully to present only essential information. (This accords well with the Leon Lederman Principle that any good theory must fit on a T-shirt!)

Electron linacs dominated, rather than the proton machines of yesteryear, with very high energy colliders as the vision of the future and with 'Star Wars' implications already with us. The spectre of classified information was evident in a number of the talks.

Radiofrequency quadrupoles,



▲
A five-cell niobium superconducting accelerating cavity showing the rotating array of finger-like temperature sensors which look for heating of the resonator surface. The cavity design was developed at Cornell for the proposed US Continuous Electron Beam Accelerator Facility, CEBAF, and prototypes are being made by West German and US industry for special testing.

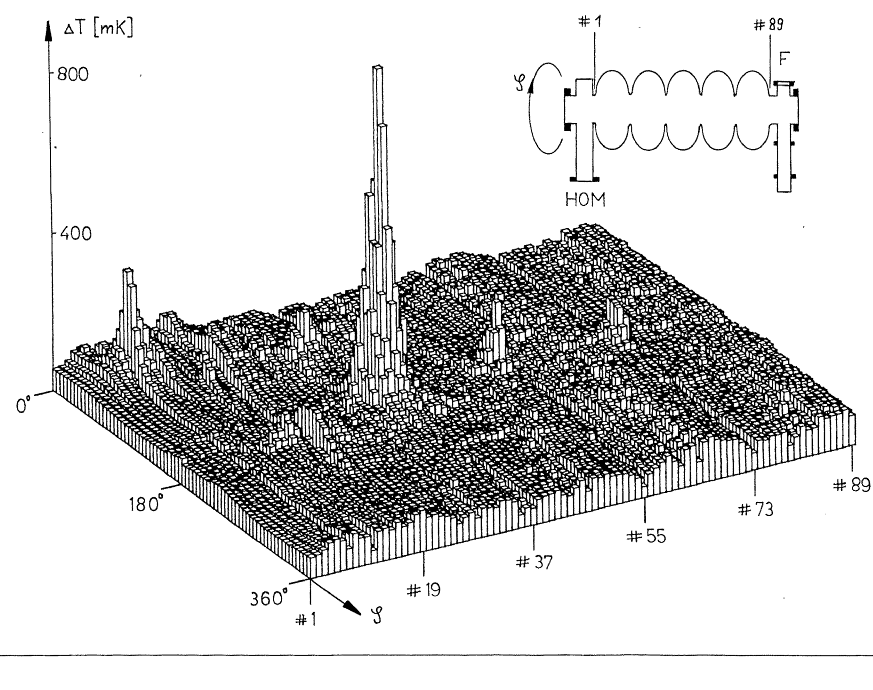
(Photo Interatom)

Cryogenic cavities

If approved, the Continuous Electron Beam Accelerator Facility, CEBAF, proposed for US nuclear research (see April issue, page 17) would be the first machine to use superconducting radiofrequency accelerating cavities on a large scale.

To push the development work along, Cornell University's superconducting r.f. group has been collaborating with CEBAF to stimulate industrial interest in making superconducting cavities for the new linac. Involved in the prototyping programme so far are Interatom and Dornier from West Germany, together with Babcock and Wilcox and TRW in the US.

Cavities from the last three named firms undergo final surface preparation and testing at Cornell, while Interatom units are tested at the University of Wuppertal. The complete CEBAF linac would require 418 cavities.



▶
A temperature map of a prototype CEBAF cavity. Pinpointing localized heat losses enables repair work to be guided, and is essential in improving cavity performance.

highfliers of the previous Conference, are now standard fare and there was not much new information. Very high intensity linacs were prominent for ions, neutral particle production and free electron lasers. Some of this work is related to achieving fusion by heavy ion implosion of pellets (induction linacs), some for free electron lasers — prodigious sources of radiofrequency power, and all is related to future particle physics machines (like the Andy Sessler two-beam scheme at Berkeley).

Star Wars enters immediately here and hundreds of millions of dollars goes to this sort of work in the Livermore Laboratory alone. Livermore is working on large ground-based free electron lasers while Los Alamos is developing compact machines (for example a 50 MW neutral particle beam generator to be carried by a satellite or a 1 MeV, 10 mA system for a rocket). There is related work on electron sources and accelerator systems to sustain the brightness and stability of high power beams. Many difficult engineering problems remain unsolved.

For particle and nuclear physics there were many contributions from CEBAF (see April issue, page 17) where there has been an encouraging start to the industrial production of prototype superconducting r.f. cavities for their electron linac. John Rees reported that the first 100 GeV electron-positron collisions at the Stanford Linear Collider are still anticipated before the end of the year. Dave Warner announced first injection from the LEP linac into the Accumulator (see page 22).

Burt Richter spoke on future linacs and mentioned the ideas of Wolfgang Schnell (reported in the July/August issue, page 10) for a two beam scheme with a superconducting drive linac, as being on the brink of feasibility. On more exotic ideas, there was news from Quebec of the first observed acceleration in a plasma beat-wave system where an accelerating gradient of 1 GeV per metre was achieved over 1 mm.

This whole topic of achievable accelerating gradients has been revolutionized since the measurements at Stanford, followed by Los Alamos and Japan as reported by Stan Schriber. In conventional structures at S-band frequencies over 310 MV per metre is recorded and over 440 MV at C-band.

Applications in medicine and industry continue to abound. Isotope production and ion implantation had specific mention and it is clear that the new sources of coherent radiation — wigglers, undulators, FELs are of great interest for medical purposes.

(From Herbert Lengeler)

Teachers from European schools recently came to CERN for a four-day practical course on microelectronics given by P. J. Hayman (standing, rear) of Liverpool and supported by Plessey Semiconductors.

(Photo CERN 616.6.86)

Physics monitor

WEAK INTERACTIONS
Drying out the swamp

An analysis of experimental results covering 25 years by three physicists from the Institute of Intermediate Energy Physics of the Swiss Federal Institute of Technology at SIN, Villigen, underlines the totally left-handed nature of the electrically charged component of the weak nuclear force acting between electrons, muons and their respective neutrinos.

The problem was formulated in 1950 in the most general way by Louis Michel and posed a formidable task to the experimenters: the determination of 10 complex or 19 real numbers!

Now this has been done. The six key experiments — besides the discovery of the muon — come from CERN, Enrico Fermi Institute (Chicago), Nevis Laboratory (Columbia), SIN (Switzerland) and TRIUMF (Canada). Today all these experiments would probably be called 'low energy', but not that long ago many physicists would have classified two of them as 'high' and four of them as 'intermediate' in energy. These last four turn out to be extremely important. They alone fix 16 out of the 19 unknowns, and the lifetime measurement provides one more. Using in addition two CERN results — the neutrino helicity measurement from pion decay (1961) and the muon production rate in neutrino-electron collisions from the CHARM collaboration (1982) — enables all 19 numbers to be fixed, thus completely nailing down the charged leptonic weak interaction, at least at energies below that of the W particle which carries the charged weak force.

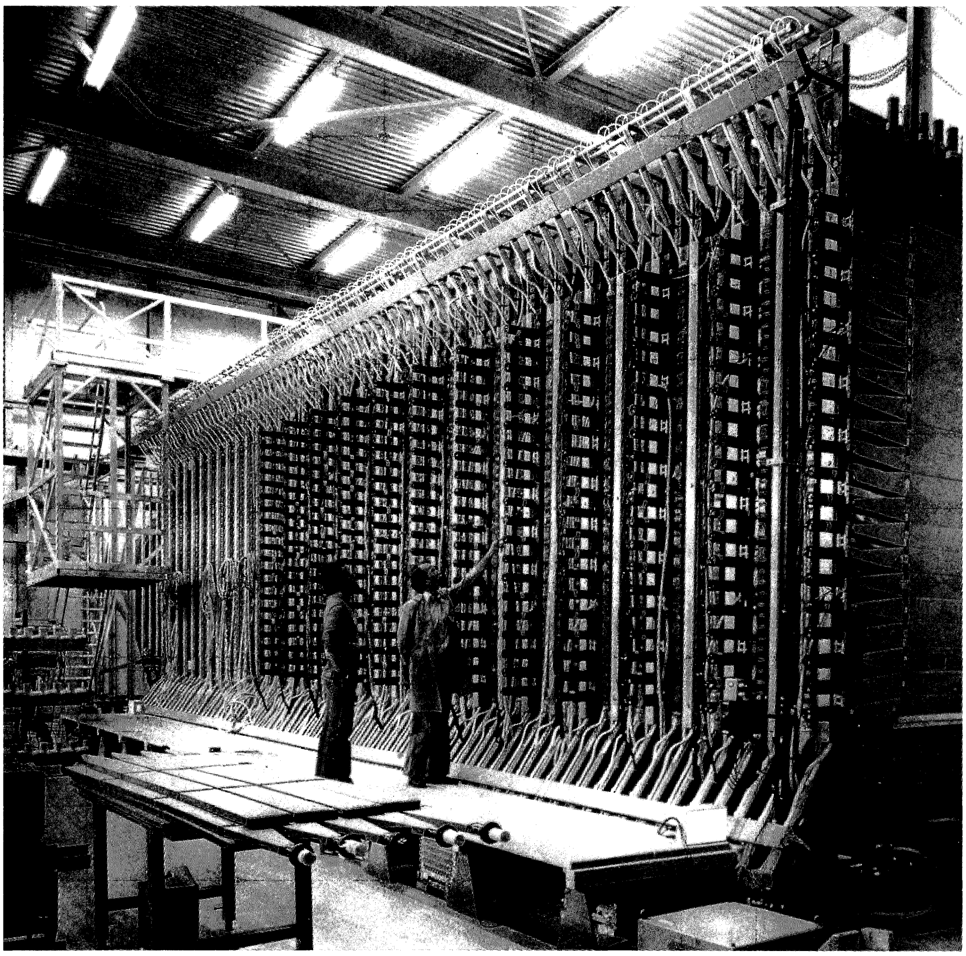
Theoretical milestones for this analysis have been set by Fierz (1938), who wrote down the necessary basic transformations, by Kinoshita and Sirlin (1957) and by F. Scheck (1983), who have worked out the relations between experimental results and the coupling constants, and by Cecilia Jarlskog (1965), who discussed the limitations of muon decay experiments and pointed out that neutrino measurements cannot be avoided. Thus the task looked difficult. The term 'swamp of the coupling constants' was coined.

The new analysis starts with a particular grouping of the handednesses of the observed particles and systematically exploits the simple fact that a vanishing sum of absolute sqares of complex numbers requires each of them to vanish. For this reason a small number of experiments determine a big number of unknowns.

By H. J. Gerber. The paper, by W. Fetscher, Gerber and K. F. Johnson, was published in Physics Letters, Volume 173B, page 102.

The CHARM experiment using CERN's high energy neutrino beam provided vital information on neutrino interactions with electrons.

(Photo CERN 105.7.78)



WORKSHOP Accreting X-ray sources

Earlier this year a workshop on 'High Energy/Ultra High Energy Behaviour of Accreting X-Ray Sources' was held in Vulcano, a small island near Sicily, jointly organized by the Italian Istituto Nazionale di Fisica Nucleare and Consiglio Nazionale delle Ricerche. About 60 astrophysicists and particle physicists attended the meeting which covered the study of galactic cosmic sources emitting in the wide energy range from the optical region to some 10^{15} eV.

Almost all such sources are believed to be binary systems in which matter accretes on a compact star (pulsar or black hole) which acts as an 'orbiting accelerator'. In recent years this field has attracted a large particle physics interest following the observation of periodic emission of ultra high energy photons (10^{12}-10^{15} eV) from stellar objects like Cygnus X3 and Hercules X1.

Some astrophysics and cosmic ray experts gave review talks on the acceleration and emission processes as well as on the significance of the experiments. At low energies (X-ray range) the data on periodic emission are well established and act as a guideline for researches at higher energies. In the range of ultra high energy photons the situation seems less clear. The results are sometimes contradictory, perhaps reflecting variations in the activity of the source on time scales of the order of some years. This possibility is also supported by theorists who pointed out that the extremely high energy output (10^{39}-10^{41} erg/s) together with the compactness of the systems can produce strong variations and short lifetimes. The intensity of Cygnus X3 in particular is known to be variable at X-ray and radio energies.

There was general agreement that point sources generate very energetic photons, which at these energies can only come from the decay of neutral pions. There is little doubt that in order to have such photons, source protons of 10^{17} eV are needed. Thus accreting objects can be considered candidates for the origin of the highest energy cosmic rays.

The meeting was noteworthy not only for the diverse backgrounds of the participants but also for widely different points of view.

MEETING Photon collisions

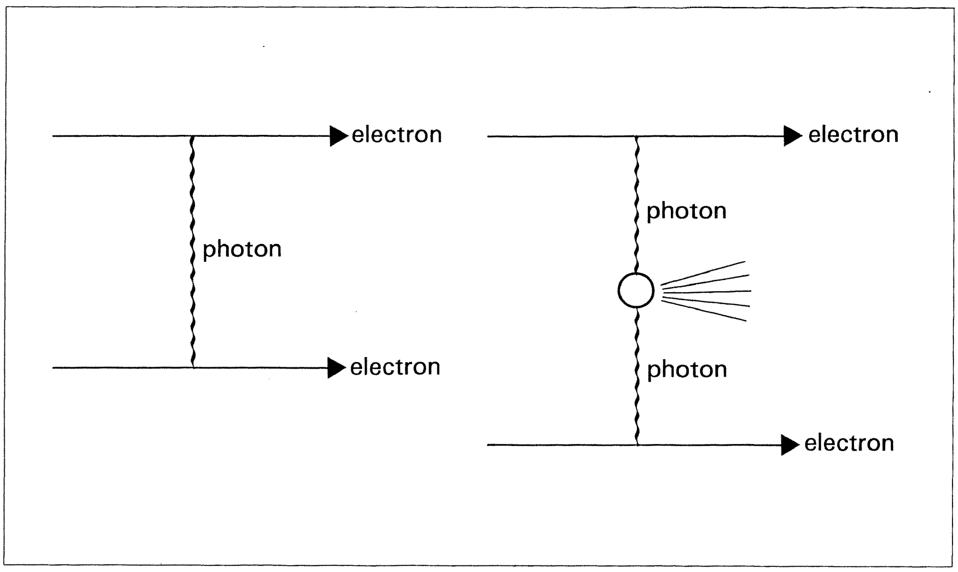
Participants at an international meeting on photon-photon collisions held earlier this year at the Collège de France, Paris, and organized by the Collège de France and the Orsay Laboratory, heard new results from Novosibirsk, DESY (Hamburg) and Stanford.

Numerous measurements on the radiative width of light mesons (spin-parity 0^- and 2^+) were summarized, together with their implications for the particles' quark/gluon content, while new results were presented on production processes, the strong interaction behaviour of the photon, etc.

As well as being able to compare photon-photon results to those actually observed in related processes, speakers were able to anticipate related processes such as collisions between the W and Z carriers of the weak force.

The next meeting in the series will be held in Israel in Spring 1988.

The electromagnetic force between two particles is transferred by a (virtual) photon (left). On rare occasions (right), photons are emitted by each particle and subsequently interact, giving light-light scattering. These photon-photon processes were the subject of a recent meeting at the Collège de France, Paris.



People and things

On people

Awarded the degree of Doctor of Science honoris causa by the Technion-Israel Institute of Technology, Haifa, is Arno Penzias, currently Vice-President of Research at AT and T Bell Laboratories and who shared with Robert Wilson, also of Bell, a 1978 Nobel Physics Prize for their discovery of the 2.7 K cosmic background radiation which underlines a Big Bang theory of the Universe.

Arno Penzias

The Fiuggi Foundation Prize 'Una vita per la Scienza, la Fisica' for 1986 has been attributed to Kai Siegbahn for his discovery of the ESCA method of chemical analysis. To Robert Hofstadter the Fiuggi Foundation has attributed the 'Special Prize for Technology' for his invention of the sodium iodide gamma spectrometer.

The meeting of the Committee chaired by the Italian Foreign Minister Giulio Andreotti took place at CERN on 13 May.

New ECFA Chairman

At its Plenary Meeting on 20 June the European Committee for Future Accelerators elected Italo Mannelli to succeed Jean Sacton as ECFA Chairman as from the beginning of next year.

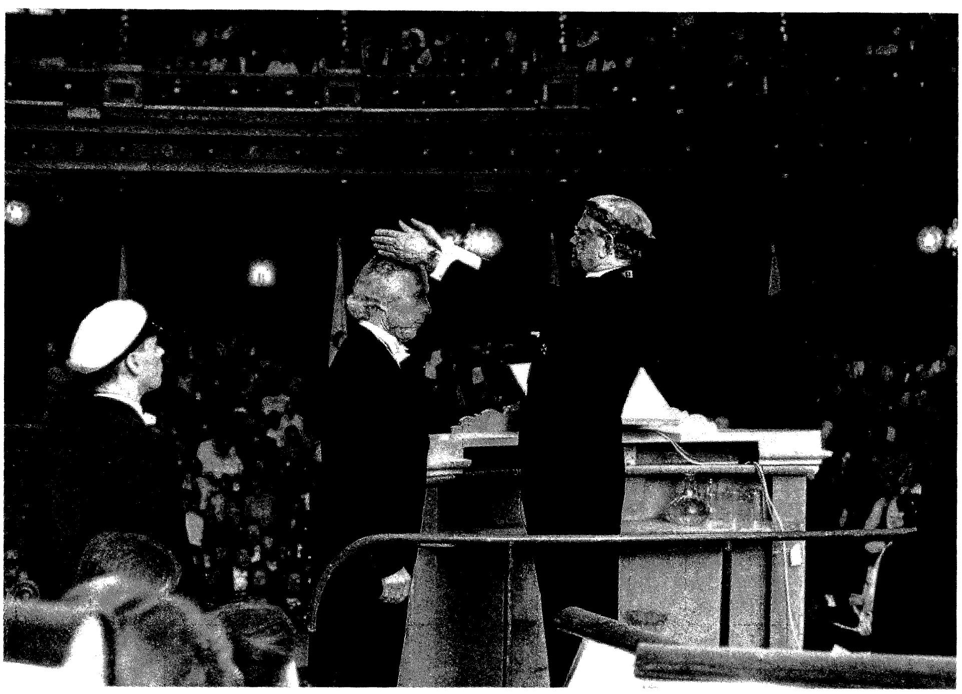
Jean Sacton has done much during his term of office to maintain the important role of ECFA as a forum and a voice for all components of the European particle physics community and to ensure the European voice was heard on the world stage.

This was reflected at the recent plenary meeting of ECFA where among other items on a packed agenda Carlo Rubbia made an impassioned presentation of the interim findings of CERN's Long Range Planning Committee (see page 17).

Friends and colleagues of Boris L. Ioffe gathered recently at Moscow's Institute of Theoretical and Experimental Physics to celebrate the 60th birthday of this distinguished Soviet theoretician and spare time mountaineer (seen here on a glacier in the Pamir mountains).

On 30 May Tom Ypsilantis received the degree of doctor honoris causa at the University of Uppsala, Sweden, for his contributions to the experiment at Berkeley in the 1950s that led to the discovery of the antiproton and for his pioneering work in the development of new detection techniques.

Tom Ypsilantis receives the degree of doctor honoris causa of the University of Uppsala, Sweden, from Ake Sundborg, Promotor of the Faculty of Science.



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We are presently searching for a Group Leader to develop an active research program in theoretical physics. Reporting to the Scientific Director on technical issues, the candidate will direct a theoretical physics effort in close collaboration with the experimental program at CEBAF. Further, the Group Leader will initiate a supportive liaison with CEBAF's user community as well as foster the development of young physicists through university programs, colloquia, symposia and meetings.

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Personnel Director
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Newport News, VA 23606

Qualified candidates will be referred to the Search Committee, chaired by Joe Redish (Maryland) and including Sid Drell (SLAC), Jim Friar (Los Alamos), Ernie Moniz (M.I.T.), and Bill Turchinetz (M.I.T.).

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L'Institut de Physique Nucléaire (IPN) désire engager un jeune physicien expérimentateur en physique nucléaire et/ou des particules élémentaires, pour un poste à statut définitif, dans le personnel scientifique permanent de l'Université Catholique de Louvain. Il est prévu que ce poste sera ouvert en septembre 1987.

L'IPN est un institut de recherche en physique expérimentale nucléaire et des particules élémentaires, financé conjointement par l'Université Catholique de Louvain (UCL) et l'Institut Interuniversitaire des Sciences Nucléaires (IISN) qui est l'organisme belge de financement des recherches nucléaires fondamentales dans les Universités.

L'outil principal de l'IPN est un cyclotron isochrone K = 120 MeV, pour l'accélération d'ions légers et lourds. Il est pourvu d'une source d'ions lourds à Résonance Cyclotron des Electrons (ECR) de hautes performances, et il accélère une large gamme de faisceaux de haute intensité, actuellement jusqu'au Xénon. Les équipements disponibles pour la recherche autour du cyclotron comportent divers systèmes de détection et de spectroscopie pour des neutrons, des ions légers et lourds, des électrons (avec polarimétrie des positrons) et des rayons γ (avec suppression Compton), un séparateur d'isotopes en ligne (LISOL) pourvu d'un dispositif d'orientation nucléaire à basse température (KOOL). Est également disponible un accélérateur de Van de Graaff de 4 MV, surtout utilisé pour des études d'implantation avec noyaux polarisés. L'Institut participe également à plusieurs expériences auprès de grands accélérateurs en dehors de la Belgique, en physique des ions lourds (GANIL, Caen, et SARA, Grenoble) et en physique des particules élémentaires (CERN, Genève, et SIN, Villigen).

Les candidats doivent être intéressés par les recherches menées par l'Institut, en particulier en physique des ions lourds et/ou en physique des particules élémentaires; une expérience de plusieurs années de recherches post-doctorales est indispensable. Une connaissance élémentaire du français est souhaitable; les candidats devront s'engager à l'apprendre jusqu'au niveau requis pour des tâches d'enseignement.

Les candidats pour le poste décrit ci-dessus sont priés d'envoyer leur «curriculum vitae», la liste de leurs publications, des indications sur leur expérience pédagogique, et les noms et adresses de trois personnes pouvant donner des références à leur sujet, dès que possible et au plus tard le 15 décembre 1986 à l'adresse suivante:

Professeur Jean Vervier
Université Catholique de Louvain
Institut de Physique Nucléaire
Chemin du Cyclotron 2
B-1348 Louvain-la-Neuve, Belgique

The meeting planned for Erice, Sicily, this summer in honour of Viktor Weisskopf was postponed as the great man had to go into hospital for an operation. CERN seemed especially empty this summer without him, and we wish him a full and speedy recovery.

Marc de Hemptinne (1902-1986)

Marc de Hemptinne, Emeritus Professor at the Catholic University of Louvain (Louvain-la-Neuve) and one of the most influential figures in post-war nuclear physics in Belgium, died on 1 April.

His personal contributions to physics were in molecular spectroscopy, but as Director of Louvain's Institute of Physics he contributed greatly to the birth of nuclear and elementary particle physics in Belgium. After contacts with Lawrence, he went ahead with the construction of Belgium's first cyclotron and built up around it a team which was to seed Belgian elementary particle physics.

He witnessed the movement to found CERN and was a member of the Organization's first council from 1954-57.

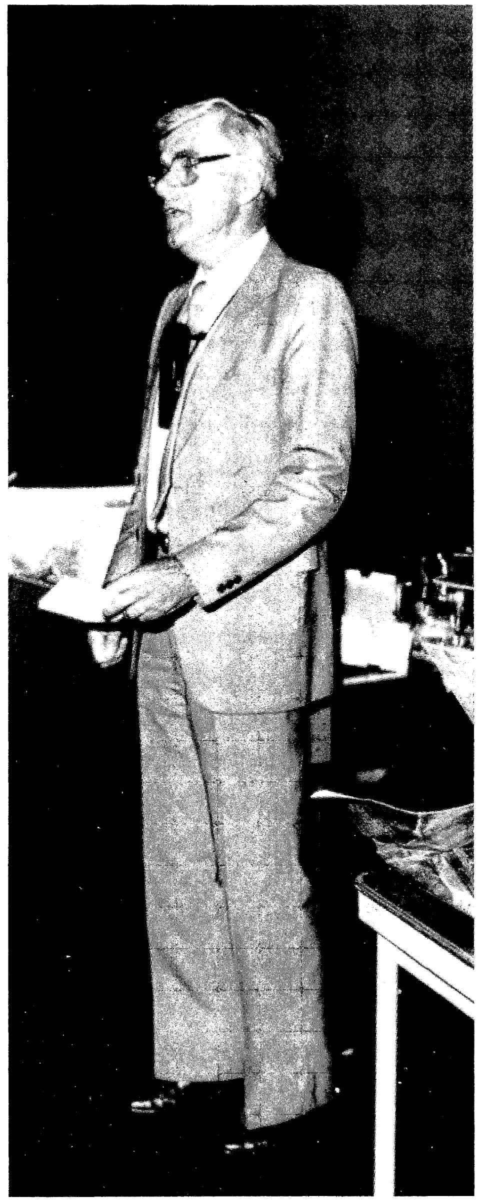
His students and colleagues will remember him as influence which helped them to mature.

Kjell Johnsen retires

One of the dominant figures of the CERN accelerator physics community retired at the end of June. Kjell Johnsen, from the days of the construction of the Proton Synchrotron to the recent creation of the flourishing CERN Accelerator School, has made major contributions to the work of the Laboratory. His broad knowledge of the field and his careful analytic mind have made him a valuable member of any team, most recently in his continuing chairmanship of the electron-positron collider subpanel of the CERN Long Range Planning Committee (see page 17).

It is however as leader of that remarkable team that built the CERN Intersecting Storage Rings that Kjell Johnsen is best known. When construction began, the feasibility of physics from hadron colliders was still in doubt. The machine was so superbly built that it swept all before it — exceeding design parameters by far, contributing greatly to knowledge of accelerator physics and technology, paving the way for the hadron colliders of today and of the future. Kjell Johnsen can take much of the credit for this achievement.

Kjell Johnsen — valuable member of any team



On 11 June, Federal German President Richard von Weizsäcker visited CERN. He is seen here (left) studying the visitors' book with Director General Herwig Schopper.

(Photo CERN 296.6.86)

'Mountain top' experience

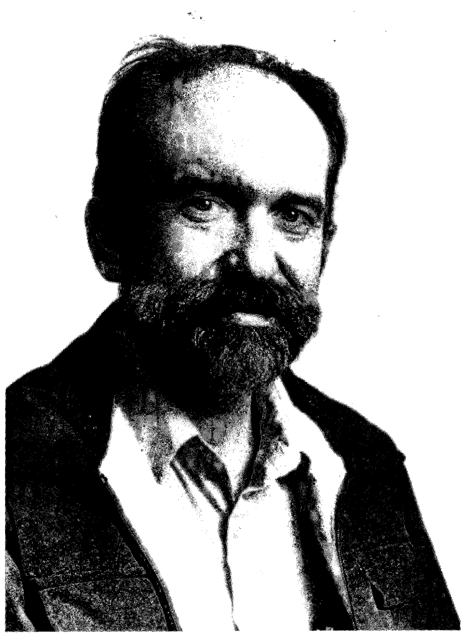
'I have reached home, but am not the same. I have been to a mountain top experience in the Conference on the Teaching Modern of Physics. It is a rare experience for a teacher to be permitted to associate with the recognized leadership of a field and feel no fear of appearing 'ignorant'. On top of that, to be meeting in one of the premiere facilities of science compounds the feeling of respect and privilege to be one of those studying physics, and striving to teach the subject. I love teaching, but need to be fed myself. That is what this session has done for me. I know that my courses will be different, starting tomorrow morning. The details unknown, the general outlines are in place.'

These words reflected the feelings of 135 high school and college teachers who recently came to Fermilab for the second conference in a series on the teaching of modern physics, sponsored by the International Commission on Physics Education. The first was held at CERN in 1984. Topic lectures were given by leading physicists and participants were grouped into working groups, each with a Fermilab physicist.

Reorganization at Fermilab

Roger Dixon, formerly Deputy Head of Fermilab's Research Division, has been named Head of Program Planning at the Laboratory. Ken Stanfield, the Head of the Research Division, appointed Peter Garbincius as the new Deputy Head and Ray Stefanski the Associate Head of the Division. Stefanski was also named Head of the new Research Facilities Department, with Stephen Pordes as Deputy Head. The new department contains almost all of the Research Division's physicists who work on fixed targets and is responsible for coordinating the installation, execution, and removal of experiments and beams in the fixed target experimental areas. During the next fixed target run, 16 beamlines will feed 16 different experiments simultaneously.

As part of the reorganization, Jeff Spalding was appointed Head of the Site Operations Department, with Greg Bock as Deputy Head. This department is responsible for overall site support and operation of the fixed target experimental areas at Fermilab. During the next fixed target running period, the Operations Group of the Site Operations Department will operate all 16 external proton beamlines and provide operations support for the forthcoming Collider run.



Roger Dixon (top) is the new Head of Program Planning at Fermilab. Jeff Spalding (centre), becomes Head of Site Operations Department, while Ray Stefanski (below) is Associate Head of Fermilab's Research Division and Head of the Laboratory's new Research Facilities Department.

RESEARCH SCIENTISTS EXPERIMENTAL HIGH ENERGY PHYSICS

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Dr. Joseph Lannutti
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SOUTHEASTERN UNIVERSITIES RESEARCH ASSOCIATION

PRESIDENT

SURA invites nominations and applications for the position of President of the Association. The President is the chief executive officer and reports directly to the Board of Trustees.
SURA is a consortium of 35 universities in the southeast and is dedicated to planning and managing research facilities which are not appropriate for a single university. At present, SURA is involved in two major enterprises, CEBAF, the Continuous Electron Beam Accelerator Facility in Newport News, Virginia and SURANet, an NSF supported computer network for southeastern universities.
The duties of the President include general oversight of the activities of CEBAF and SURANet, negotiation with federal agencies for funding and execution of contracts. At present, about 80 % of the President's time is spent in support of CEBAF. The President also represents the interests of SURA to the several constituencies in Washington and elsewhere. The President is expected to provide leadership in discussions of new projects which might be appropriate for SURA sponsorship.
The offices of SURA are in Washington, D.C. The desired starting date is January 1, 1987 or as soon thereafter as possible. Salary is negotiable.

The President of SURA should:
1. Be a scientist or engineer with a distinguished record of accomplishments.
2. Have significant experience in the management of major scientific research projects in universities or national laboratories.
3. Have extensive experience in dealing with funding agencies and the federal scientific advisory machinery.
4. Have a demonstrated record of experience with and understanding of American universities.

Applications will be received until a suitable candidate is identified. Please send nominations or applications with a complete CV, a statement of interest, and the names and addresses of three references to:

Dr. George W. Wheeler, Chairman of the Board
Office of the Provost
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DPF 87

The next regular meeting of the Division of Particles and Fields of the American Physical Society will take place from 14-17 January 1987 in Salt Lake City, Utah, hosted by the Department of Physics of the University of Utah. This divisional meeting has recently assumed an international character and has grown considerably in popularity. The three and a half days of sessions will include invited plenary talks and parallel sessions for invited and contributed papers. It is traditional at these meetings to accommodate as many as possible of the contributed papers. Since the Salt Lake meeting comes close on the heels of the July Berkeley high energy physics conference, it will be possible to give the most rapidly developing fields of research greater emphasis. Thus, although all areas of current research of interest to members of the Division will be represented, more emphasis will probably be given, among other topics, to theoretical developments in and observations relevant to superunification theory, weak mixing and CP violation, and plans for the Superconducting Supercollider. The deadline for abstracts of contributed papers is November 17.

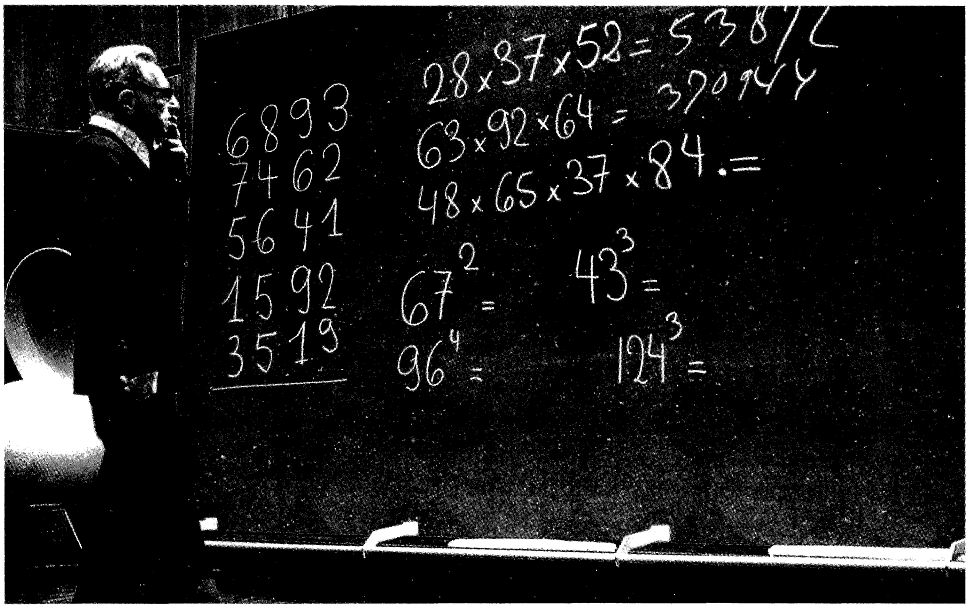
Those interested should watch for future announcements and a registration form in the Bulletin of the American Physical Society or contact the DPF Conference Secretary, 201 J. C. Fletcher Building, Department of Physics, University of Utah, Salt Lake City, UT 84112, USA.

Meetings

A meeting on Computing in High Energy Physics will be held from 2-6 February 1987 at Asilomar State Beach, Monterey, California, arranged by the Stanford Linear Accelerator Center (SLAC) and the Santa Cruz Institute for Particle Physics. Attendance is open but onsite accommodation is limited to 200. In addition to invited talks, a limited number of contributed papers will be presented. Registration deadline for onsite accommodation is 1 November.

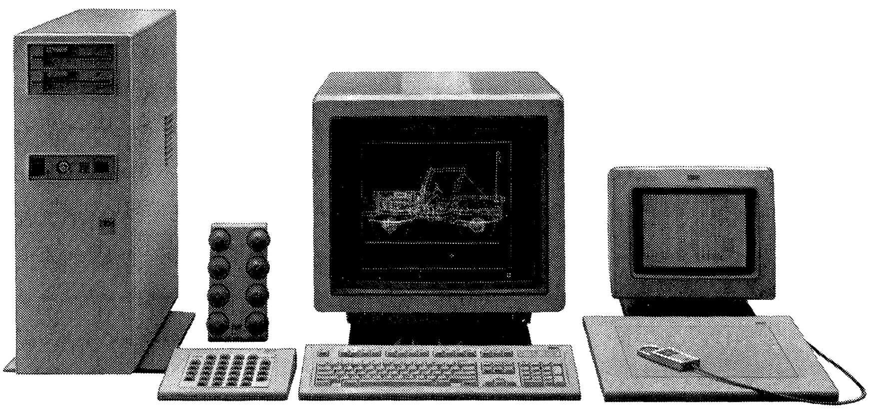
Further information from G. Hamel, Santa Cruz Institute for Particle Physics, University of California, Santa Cruz, CA 95064, USA. Electronic address, ASILOMAR AT SLACVM.

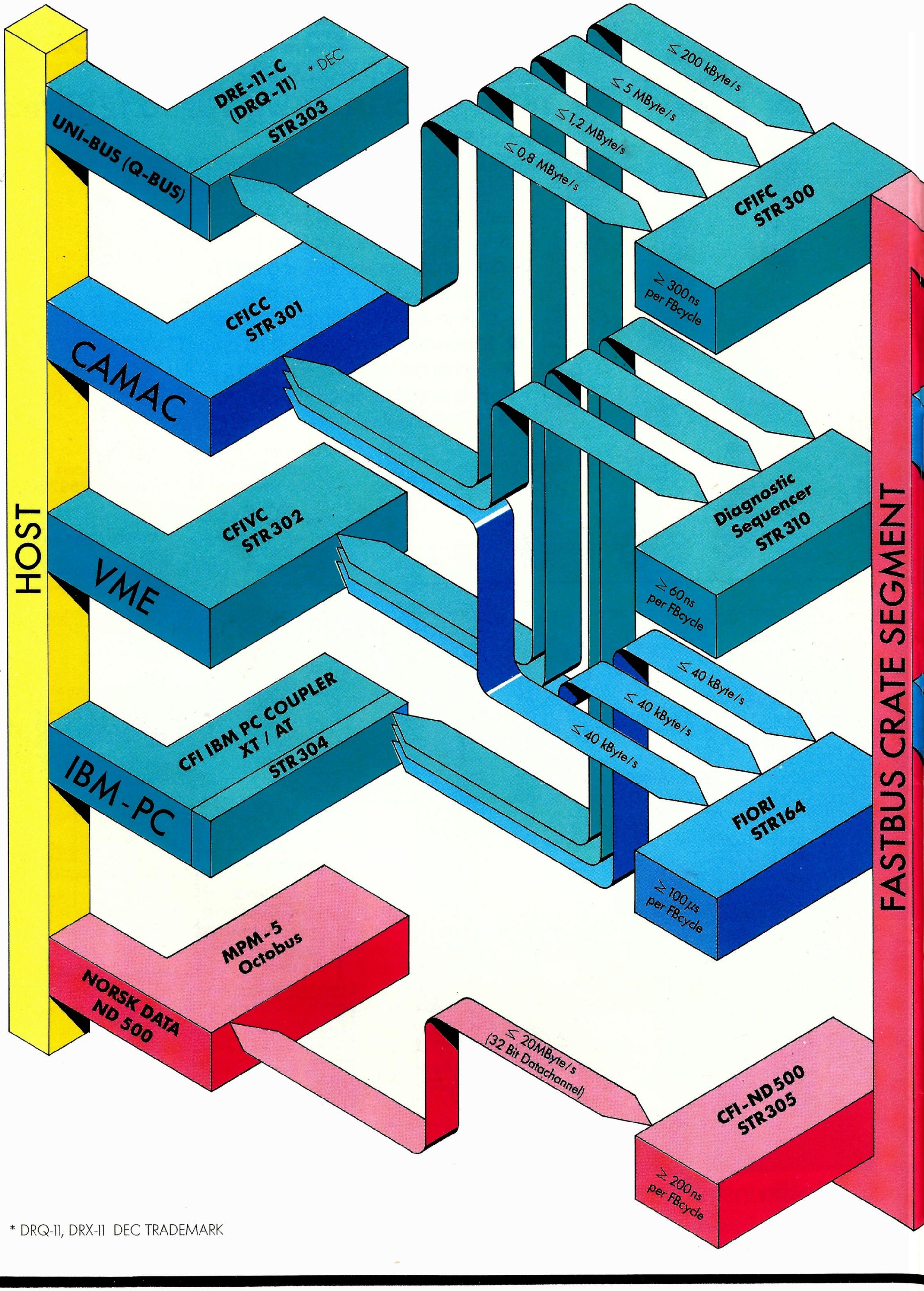
New regulations have made personalized car licence plates very popular in the US state of Illinois. This example recently appeared on the car of Fermilab Director Leon Lederman.



The 'human computer' Wim Klein was brutally murdered at his home in Amsterdam on 1 August. Klein worked at CERN from 1958 to 1968, but frequently returned to amaze his audiences with demonstrations of his incredible numerical ability.

(Photo CERN)





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