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Reader service form, page 4.

Cover photograph:
Behind the scenes at the recent Joint International Lepton-Photon Symposium and Europhysics Conference on High Energy Physics (September, page 1) many people were busy, ensuring the big meeting ran smoothly. Some of them emerged to pose in front of part of the accompanying CERN exhibition at the Geneva International Conference Centre. Others were still too busy!

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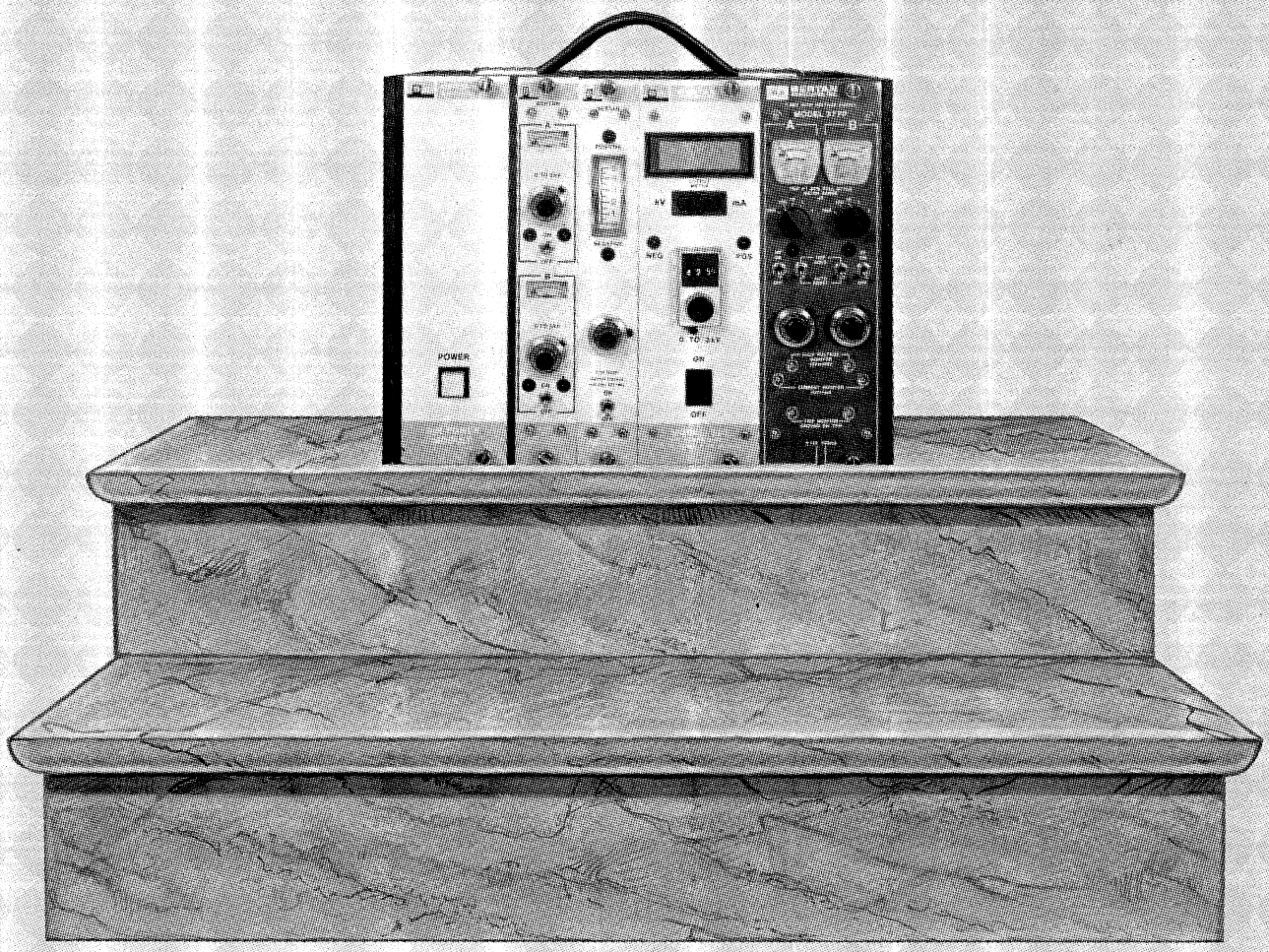

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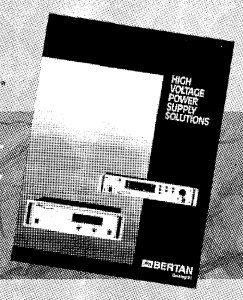

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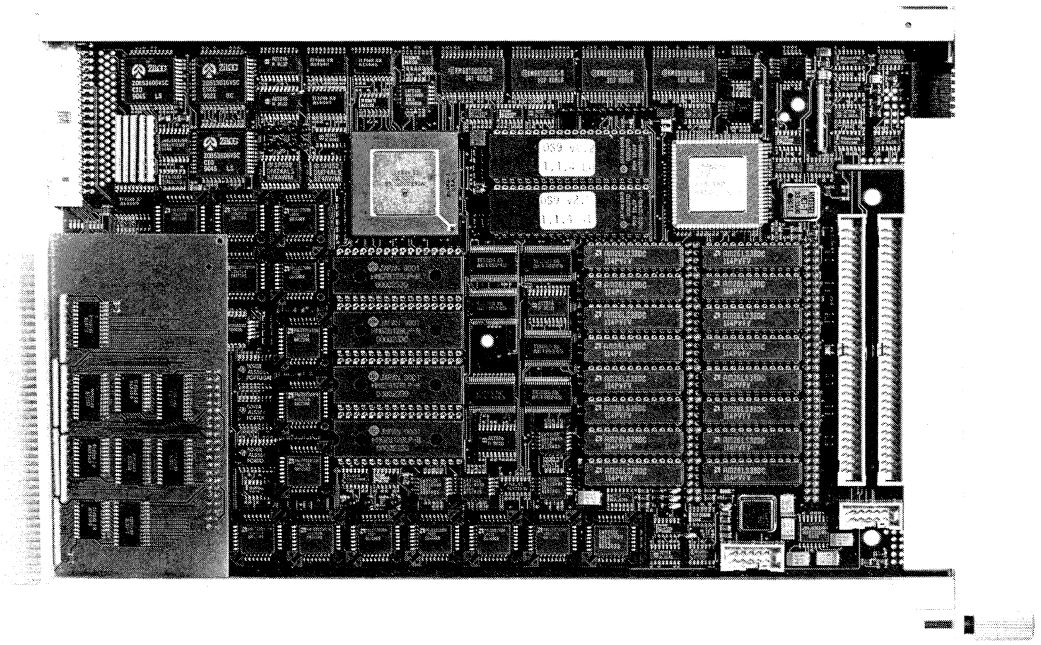

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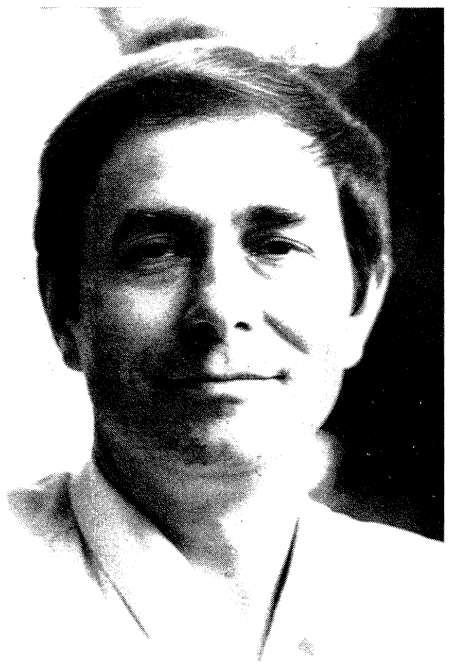
Higgs hints

At the recent Joint International Lepton-Photon Symposium and Europhysics Conference on High Energy Physics held in Geneva, Michel Davier of Orsay, speaking on searches for new particles at LEP declared 'the Higgs hunt is now on in earnest.'



As well as dominating the news at the recent Joint International Lepton-Photon Symposium and Europhysics Conference on High Energy Physics in Geneva (September, page 1), results from the four big experiments – Aleph, Delphi, L3 and Opal – at CERN's big LEP electron-positron collider had far-reaching implications.

'New evidence from LEP presented at this Conference has started to shed some light on what may be ahead of us,' said CERN Director General Carlo Rubbia in his summary talk.

Benefiting from this increased illumination is the mass-generating (usually referred to as the 'Higgs') mechanism. Peter Higgs, now at the University of Edinburgh, was one of the imaginative theorists who in the 1960s introduced new ideas of spontaneous symmetry breaking into the framework which eventually led to the electroweak synthesis of electromagnetism and the weak force.

Spontaneous symmetry breaking best illustrated by examples. Abus Salam cites a round table set for a meal, with a napkin between each place setting. The symmetry is perfect until the first guest sits down and has to choose whether to take a napkin from the right or the left. Having done so, all the others have to follow suit to preserve the now not-so-perfect symmetry. In his best-selling book 'A Short History of Time' (Bantam), Stephen Hawking uses the example of a ball on a roulette wheel, spinning round and round as the wheel rotates at high speed. As the wheel slows, the ball's energy gradually decreases until it eventually falls into a numbered slot.

Physicists thought that spontaneous symmetry breaking had to play an important role in the electroweak picture, but until the new developments which now carry the Higgs label, applying the idea inevitably brought unwanted massless particles. Steven Weinberg, one of the major electroweak architects with Sheldon Glashow and Abdus Salam, recalls being 'discouraged by these zero masses'.

The problem is that, while the photon is massless, the carriers of the weak force – the W and Z particles discovered at CERN in 1983 – are heavy. In fact at 81 and 91 GeV respectively they are the heaviest particles known. This mass has to come from somewhere, and the Higgs particles supply it.

The otherwise symmetric Ws and Zs swallow Higgs particles, breaking the symmetry and producing mass. The electromagnetic photon takes care to remain massless, so the mechanism splits the unified electroweak picture into the two very different phenomena we know today.

There is an analogous mechanism ('the Meissner Effect') in superconductivity, when the magnetic flux inside a current-carrying superconductor is expelled, making the conductor look diamagnetic.

The enigma of the Higgs is that, while it makes an electric motor look very different to a nuclear beta decay, until recently nobody knew what it looks like itself. The mechanism stays very aloof from everyday physics – it could be 'just' a couple of new particles, or it could be a catch-all term for a whole new domain of undiscovered behaviour.

However something must happen. If the Higgs doesn't show up eventually as a direct high energy resonance, then a new regime of strong interactions has to exist. This is the famous 'no-lose' theorem for new high energy proton colliders.

In the simplest picture, the Higgs is an isospin doublet (like the proton and neutron) but scalar (zero spin, positive parity).

With LEP mass-producing Zs, then it might spit out the occasional Higgs too, if the conditions are right. Whatever its mass, the Higgs should prefer to decay into the heaviest particles possible, but these various signatures have not been seen at LEP.

Between them, the four LEP experiments rule out Higgs effects below 57 GeV. (A possible candidate Higgs event picked up by Delphi near 35 GeV looks very unlikely as it includes additional forward tracks. At these masses, the four experiments should see about 33 events between them, and they don't.)

If LEP goes on to catch about ten million Zs (the Geneva results were based on about a million),

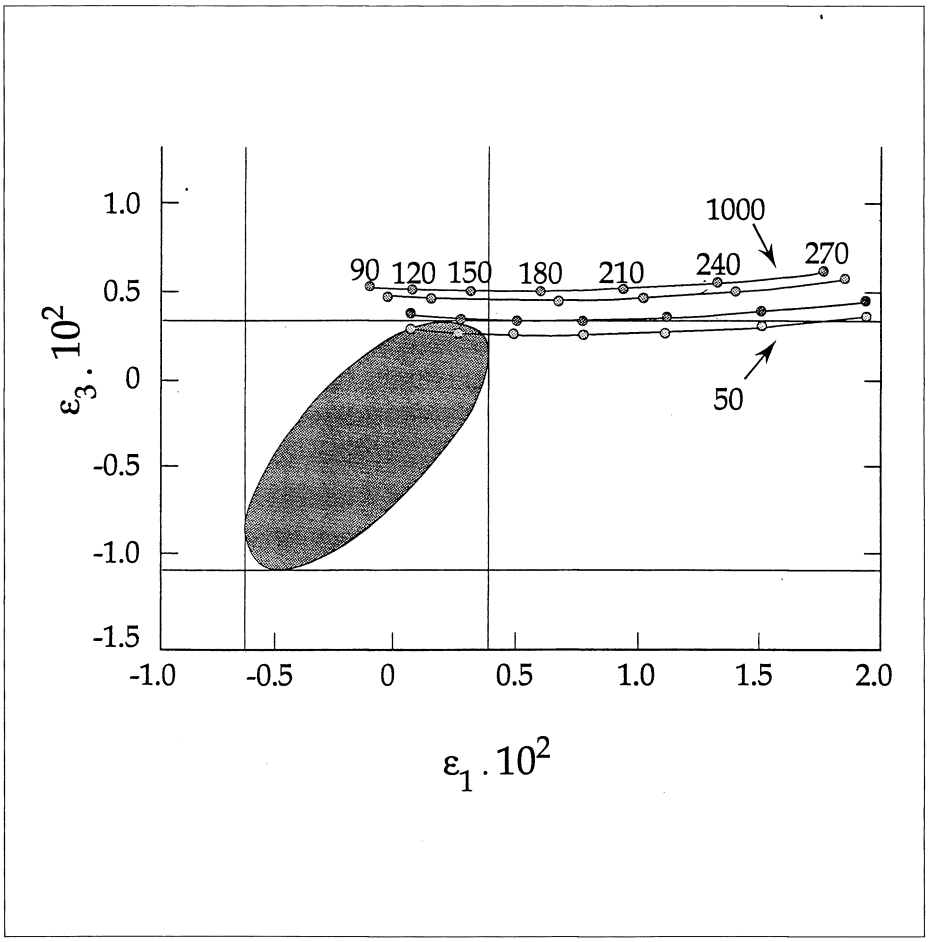
then the Higgs limit could be pushed out to 65 or 75 GeV. However the 'minimal' Higgs doublet is not the only possibility. With confidence in supersymmetry growing (April, page 3), another picture is on the market. In supersymmetry, every ordinary particle has a partner with opposite quantum statistics (each source particle, quark or lepton, having a supersymmetric – 'squark' or 'slepton' – counterpart, with the carrier particles – photons, gluons, W and Zs – having photino, gluino, etc, sisters).

Detailed analysis is continuing, but already a supersymmetric Higgs below 43 GeV can be confidently excluded.

However the most interesting Higgs hints come from indirect information. To extract precision results, LEP data has to be carefully cleansed for subtle 'radiative corrections'. Although particles like the Higgs and the sixth ('top') quark have not yet been isolated, they are nevertheless understood to play their respective roles deep inside the underlying mechanisms, and this has to be allowed for. The Standard Model shows how it has to be done, and radiative corrections are now a minor industry in high energy physics.

Self-consistency arguments with these corrections now suggest that, as well as the top quark having to live around 150 GeV, the Higgs might not be all that far away, perhaps a few hundred GeV.

This could bring Higgs effects within reach of LEP when higher energy beams become available in a few years.



In the precision experiments at CERN's LEP electron-positron collider, 'radiative corrections' take into account the effects of particles like the Higgs (mass-generating mechanism) or the sixth ('top') quark, as yet unseen but nevertheless playing an integral part in the underlying physics. Consistency arguments provide important indications of where these particles may eventually be found (shaded area). The axes are parameters which include the top quark and Higgs masses. The figures running horizontally from 90-270 (GeV) refer to the top quark mass, while the lines show the effect of increasing the Higgs mass from 50 to 1000 GeV. Neither particle looks that far away.

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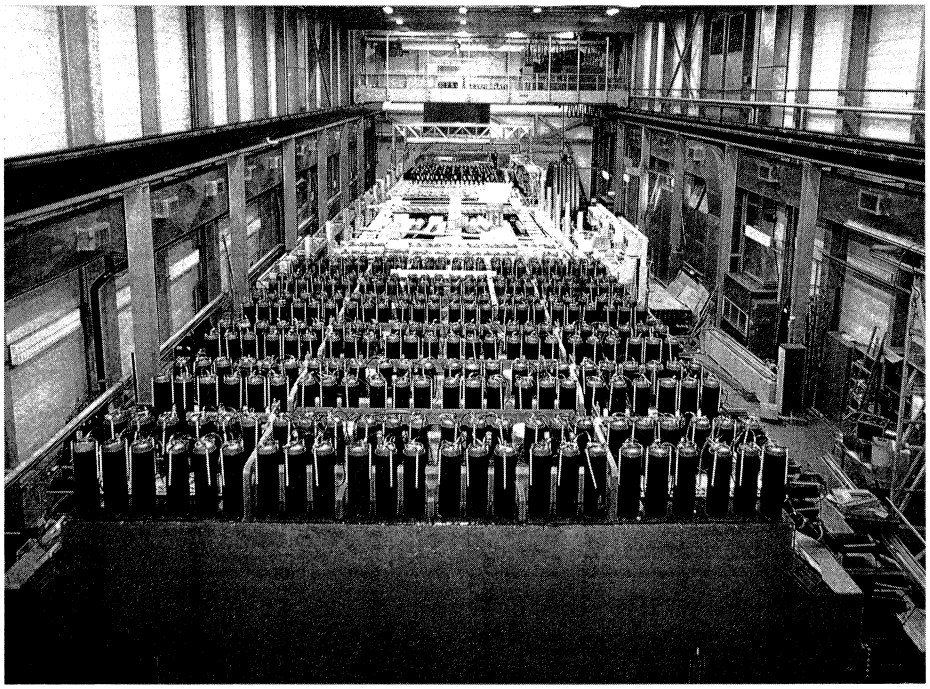
Around the Laboratories

The 40-metre CHARM II neutrino detector at CERN, seen here still under construction in 1985, has come to the end of its working life after six years studying electron-neutrino interactions.

(Photo CERN 660.10.85)



CERN
Turning off the charm

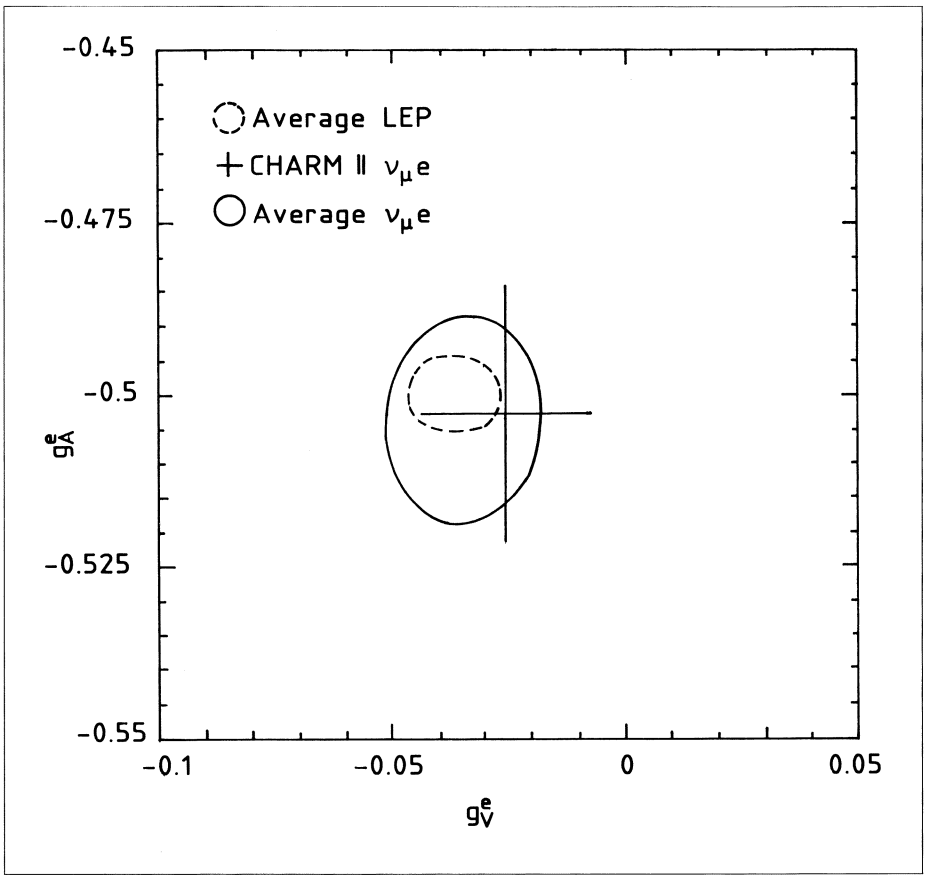
In August, the CHARM II experiment at CERN's SPS proton synchrotron was formally decommissioned, marking the end of the second generation of SPS neutrino experiments.

While the four big experiments at the LEP electron-positron collider have hit the headlines, the lower energy data from CHARM II provided the ideal complement, together giving precision measurements spanning a factor of 1000 in energy and bringing the electroweak theory virtually to textbook status.

CHARM II began operations in 1985, specializing in rare and elusive neutrino-electron scattering, where a beam particle hits a tiny atomic electron, rather than a nucleus.

These very clean interactions provide deep insights into the underlying electroweak processes. They were first seen in the Gargamelle bubble chamber in 1973, providing the first evidence for the long-awaited neutral current weak interaction and ushering in the electroweak picture. (In contrast to a classical charged current weak interaction, such as beta decay, where the participating particles swap electric charges, a neutral current interaction does not permute charges.)

Over the period 1973-85, the entire world stock of electron-neutrino data amounted only to about a hundred events, and precision



Complementary results on weak interaction strengths (A=axial vector, V=Vector) from high energy LEP experiment data and lower energy results from the CHARM II study of neutrino-electron interactions.

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***More news in a forthcoming issue.**

conclusions were difficult. During its five years of running, CHARM II carefully collected several thousand prized examples of neutrino-electron scattering – about one for every two hours of beam time.

The Brussels/CERN/Louvain/Moscow/Munich/Naples/Rome collaboration, later joined by YEFAM (Turkey) and Aachen (Germany), caught its neutrinos in 700 tons of 3.7 m-square glass plates interspersed with scintillator and streamer tubes, while a magnetized iron spectrometer downstream intercepted muons from charged current interactions.

CHARM II was the only second-generation SPS neutrino experiment. It succeeded the original CHARM study (CERN/Hamburg/Amsterdam/Rome/Moscow, with alphabetic ordering conveniently disregarded) which came into operation in 1978 immediately downstream of the famous WA1 (CERN/Dortmund/Heidelberg/Saclay) SPS neutrino experiment. When WA1 bowed out in 1984, CHARM II borrowed part of its muon spectrometer.

CHARM II used CERN's famous horn-focused wide-band neutrino beam, employed at the PS proton synchrotron from the early 1960s and subsequently transferred to the SPS in 1976. Thus for the first time in 30 years, CERN's neutrino beam is idle. New projects are on the table, but the target and beamline installations are showing their age after many years of running at maximum intensities.*

CHINA
Continuing cooperation with CERN

During a visit to China in July, CERN Director General Carlo Rubbia signed an agreement with the Chinese Academy of Sciences which provides a reciprocal framework for CERN and China to continue and develop their scientific and technical cooperation.

This cooperation will be geared to specific projects, each to be the subject of a protocol to the new Agreement, which broadly covers the participation of Chinese specialists in CERN's ongoing work in experimental and theoretical physics, detector and accelerator engineering (including the upgrading of LEP) and informatics.

In the Agreement, China also expressed its interest and intent to participate in major CERN programmes and/or projects, with the proposed LHC Large Hadron Collider in the LEP tunnel cited as a specific example.

Links between CERN and China have steadily strengthened since first contacts were made in 1973. Western knowhow helped get Beijing's BEPC electron-positron collider off the ground, while Chinese groups make significant contributions to several CERN projects, notably the L3 experiment at LEP.

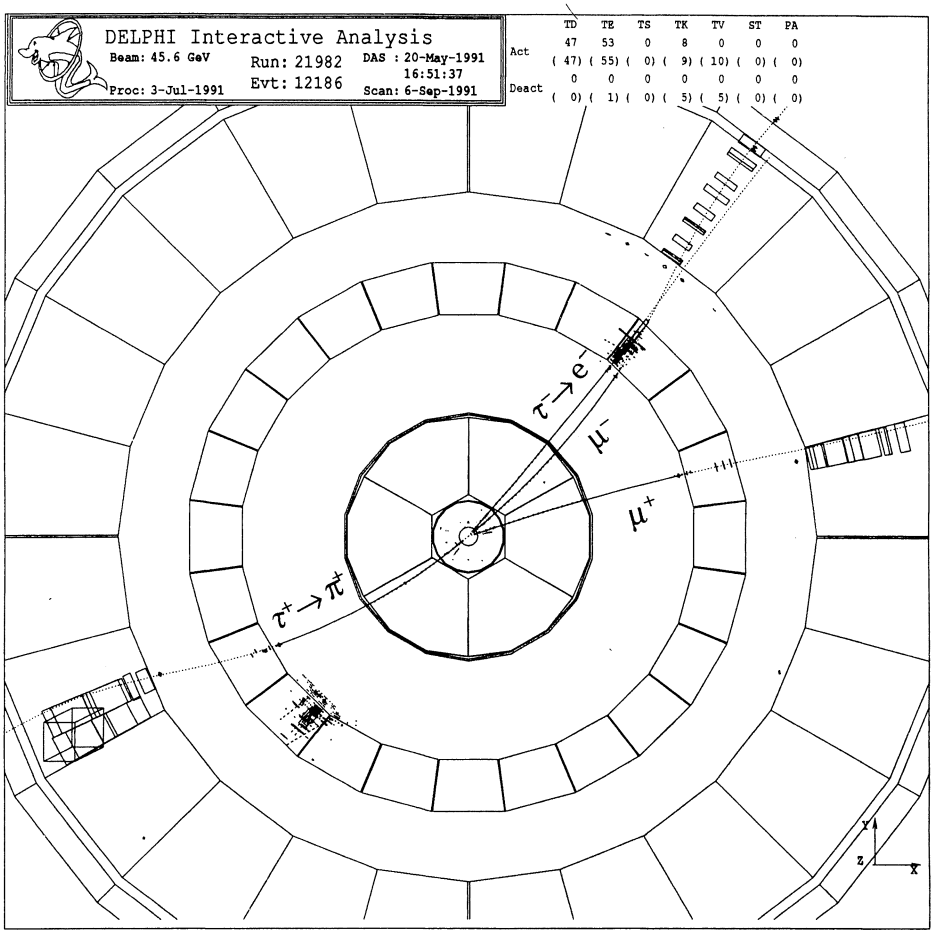
CERN
Cold water on tau pairs

Earlier this year, results from CERN's LEP electron-positron collider included a hint of a new effect seen by the Aleph experiment on the decay of Z particles into two leptons accompanied by an additional pair of charged particles. However the most recent results announced at the Joint International Lepton-Photon Symposium and Europhysics Conference on High Energy Physics (September, page 1) appeared to exclude this.

Aleph had reported a possible excess of tau lepton pairs, with 15 events, compared to ten each with muon and electron pairs, in a sample of 200,000 Z decays.

During an official visit to China where a new General Agreement of Cooperation between CERN and the Chinese Academy of Sciences was signed, CERN Director General Carlo Rubbia met Communist Party Secretary-General Jian Ze-Min (right).

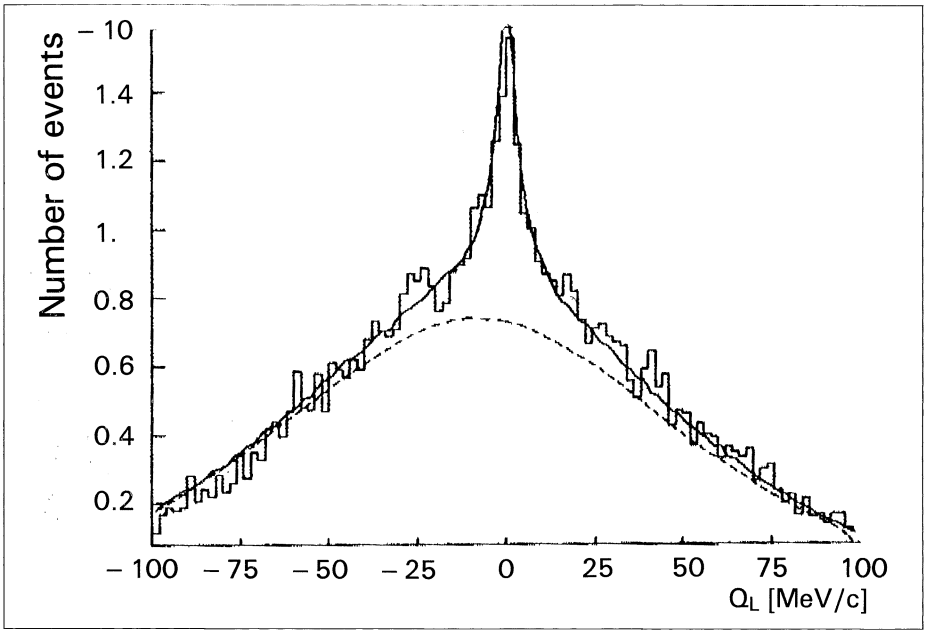
An example of a Z decay into two tau leptons and a pair of charged particles, as seen by the Delphi experiment at CERN's LEP electron-positron collider.



An extended sample allowed Aleph to update the figures to 10, 14 and 16 for electrons, muons and taus respectively. A tau excess is also not reported by Delphi and Opal in comparable samples (220,000 and 140,000 events respectively), giving a combined result of 29, 27 and 23 for the three channels, with the original Aleph figure still dominating the tau statistics.

Interpretation in terms of particle production via the conversion of an internal photon suggests slightly more electron pairs than muons, with tau pairs only about half as frequent as muons. Thus the expected signals from all events collected so far are 27 for the electron pair channel, 22 for the muons and 12 for the taus.

DUBNA/SERPUKHOV Electromagnetic effects between pions



An abrupt increase in the number of (oppositely) charged pion pairs with small relative momenta has been seen at the proton synchrotron at the Institute for High Energy Physics, Serpukhov, near Moscow.

This is due to electromagnetic (Coulomb) interactions between emerging charged pions. Such an effect was predicted by the late A.D. Sakharov back in 1948 for the case of electron-positron pairs, but is difficult to observe in this case, requiring relative momenta

Distribution of charged pion pairs with small relative momenta, as seen in an experiment at the Soviet Institute for High Energy Physics, Serpukhov, near Moscow. The sharp central increase (due to electromagnetic effects) was first predicted by A.D. Sakharov in 1948.

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below 20 keV. However for pions, the momentum limit extends to 6 MeV.

The measurements were carried out with the same apparatus used to study positronium atom production in neutral pion decays (June 1990, page 17), where the high precision follows from a thin internal target (1.4 micron tantalum foil) and a special 40-metre beam channel.

At relative momenta below 3 MeV an additional increase in charged pion pairs is expected because of the ionization of pionic atoms inside the target, and a search is on for such electromagnetic bound states of charged pions.

SUPERCOLLIDER
Second experiment

Recently, the situation regarding major detectors for the planned SSC Superconducting Supercollider in Ellis County, Texas, has changed in two ways. First, the door was closed on the L* collaboration led by Sam Ting (July/August, page 8), and second, detailed analysis of the detectors has led to increased anticipated costs for the experimental programme.

Nevertheless, the SSC Program Advisory Committee has reaffirmed its belief in the desirability, if not absolute necessity, of having two major detectors available when the SSC starts up.

Still valid is the Committee's original recommendation, made last year – 'a healthy initial program requires two detectors with complementary as well as overlapping strengths that address physics at high momentum transfer...for independent checks of results...and effective exploitation...of the SSC. It is also important to have as broad a community as possible. These goals will be effectively served by having two distinct major detectors ready to do experiments at the turn-on of the accelerator. The Laboratory should treat the two approved proposals as having equal importance and priority'.

The SDC Collaboration, led by George Trilling of Berkeley, got a green light in January to proceed from its Letter of Intent to a Technical Design Report, to be submitted next April.

Recently the SSC PAC has given some encouragement to a new Expression of Interest, now christened GEM (Gamma, Electron and Muon Experiment), led by Barry Barish of Caltech and Bill Willis of Columbia.

The PAC was pleased to receive the GEM idea with its large superconducting open-geometry solenoid, emphasizing the detection of photons, electrons and muons with high precision.

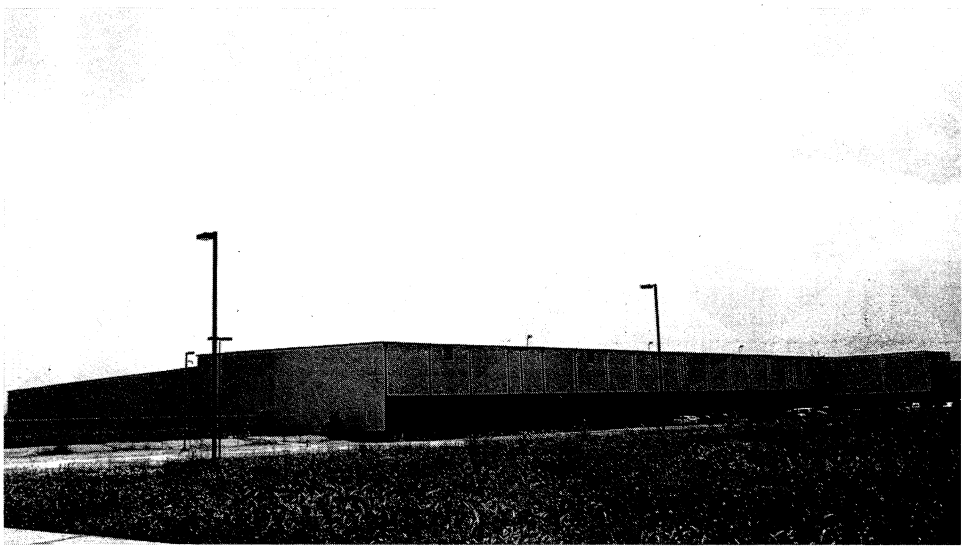
The GEM architecture as currently conceived resembles that of L*, with an outer superconducting solenoid enclosing in turn three sets of tracking chambers (for measuring muons), a hadron calorimeter, a high resolution electromagnetic calorimeter, and a small inner tracking volume.

While the PAC had some misgivings about the unshielded solenoid design, it recommended that the SSC Laboratory support the project towards technical feasibility and detailed costing. Progress will be carefully monitored.

A more modest scheme called ELMUD was also discussed. The PAC felt that it had merit, but fell short of the committee's complementary detector criteria. If two major detectors go forward, the PAC thought that most, if not all, of ELMUD's goals would be covered.

Expressed in 1990 dollars, total SSC funding for detectors, halls, and related services amounts to $931 million.

Personnel at the Superconducting Supercollider (SSC) Laboratory are moving from the Dallas area to the SSC Ellis County site, where accommodation is on a scale to match the proposed 87-kilometre circumference collider.



DESY
Zeuthen partner

From January 1992 the Institut für Hochenergiephysik, Zeuthen, near Berlin (formerly East Berlin) becomes part of the DESY Laboratory, Hamburg.

Early this year, Federal German science counsellors recognized the high scientific merit of the Zeuthen research centre and, in the context of the country's reunification, recommended that it should become part of DESY.

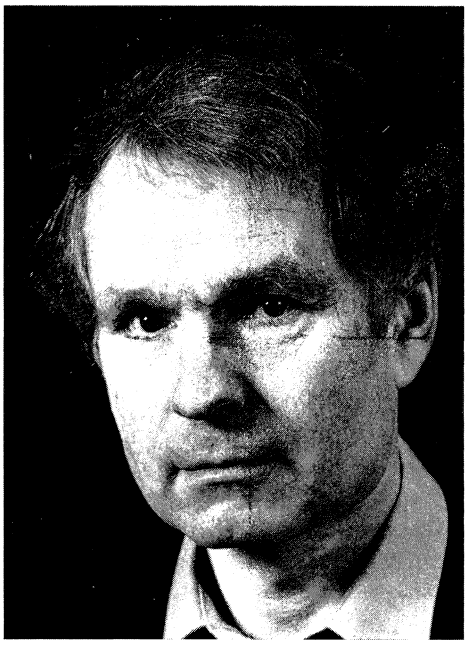
DESY will have as objective the development of Zeuthen's scientific programme. The Berlin centre has a long tradition of significant collaboration in experiments at CERN (where there is a Zeuthen team in the L3 experiment at the LEP electron-positron collider), at DESY (including the HERA electron-proton collider now being commissioned), and at Dubna and Serpukhov in the USSR. Away from accelerators, Zeuthen scientists have also collaborated in preparations for neutrino studies at Lake Baikal in the USSR (March, page 7).

For the future, increased Zeuthen collaboration in DESY experiments is foreseen, together with a research and development programme for new detector technologies, where the participation of industry in what was formerly East Germany will be sought.

Reflecting the tradition at DESY, where Federal funding is supplemented by the local Hamburg government, 90 per cent of Zeuthen's running costs (of the order of DM20 million annually) will be underwritten by the Federal government, the remainder coming from the regional Brandenburg administration.

In a future edition, we hope to have a detailed survey of Zeuthen's activities and plans for the future.

Albrecht Wagner (left) is DESY's new Research Director, taking over from Paul Söding (right), who assumes responsibility for the Institut für Hochenergiephysik, Zeuthen, formerly East Berlin.



FERMILAB
Electroweak enigma

First results are now emerging from a major Fermilab experiment which probes in detail the radiative decays of hyperons – reactions which involve strong, weak and electroweak effects. It is the latest chapter in Fermilab's tradition of detailed hyperon studies.

A US/USSR/Brazil/Mexico/China/UK collaboration, Experiment 761's initial goal was to look at the decay of charged sigma particles into a proton and a photon. With the weak interaction at work (the reaction changes the strangeness quantum number), asymmetry is important, so additional information is gleaned if the decaying hyperons are polarized (spin oriented), and the distribution of the resulting protons is measured.

In studying this reaction, it is important to filter the hyperon decays from background due to hyperons decaying into a proton and a neutral pion, with the pion subsequently decaying into a photon pair, which could mask asymmetry.

Here, major responsibility rests on the photon spectrometer, using transition radiation detectors and supplementary wire chambers, all built in Leningrad. Photon energies are mainly measured using lead-glass, but a central portion is configured with BGO supplied by ITEP Moscow and fabricated in Shanghai. Upstream, hyperon momentum is measured by nine planes of silicon strips (University of Iowa) and a magnet, while the resulting proton is measured by 30 planes of wire chambers and three magnets, supplied by Leningrad.

With a huge sample of some 38,000 events, the experiment considerably boosts the stock of

With the photon calorimeter of Fermilab's E761 experiment which has confirmed an interesting hyperon result – left to right, Michael Kubantsev, Dai Lisheng, Zhao Wenheng and Shi Huanzhang.

world data. It confirms a large negative asymmetry in the decays, an effect hinted at for years in earlier measurements, but at variance with basic theoretical ideas. With background effects now under control, the anomalous result invites explanation.

Other goals of the experiment include measuring the polarization and magnetic moment of sigma hyperons, and studying the radiative decays of other hyperons.

(From an article by Maurice Foucher and Joseph Lach soon to appear in 'Fermilab Report'.)

Omega minus magnets

In another important Fermilab hyperon result, Experiment 756 (Fermilab/Michigan/Minnesota/Rutgers collaboration) has measured a sample of 24,700 omega minus hyperons, finding that the particles' magnetic moment is −1.94 nuclear units, in agreement with basic theory.

Measurement of magnetic moments probe the underlying quark structure of strongly interacting particles. Although not easy to find, the omega minus has the simplest quark structure for magnetic analysis – three strange valence quarks with their spins aligned in parallel.

The standard technique for measuring hyperon magnetic moments is to produce a spin oriented (polarized) beam, let the spin direction precess in a magnetic field, and determine the final spin direction from the distribution of the decay products. For the omega minus, E756 chose another route, with omegas coming from a production target bombarded by a secondary electrically neutral beam containing polarized lambdas and ksis. Although hyperons constituted only about a tenth of this beam, they were very efficient at producing polarized omegas.

The parent omega polarizations were reconstructed from the polarizations of daughter lambdas, these polarizations being measured from the asymmetry of the lambdas decaying into protons and pions.

As a check, a sample of 64,000 ksi minus hyperons gave a magnetic moment of −0.688 units, in accord with earlier measurements.

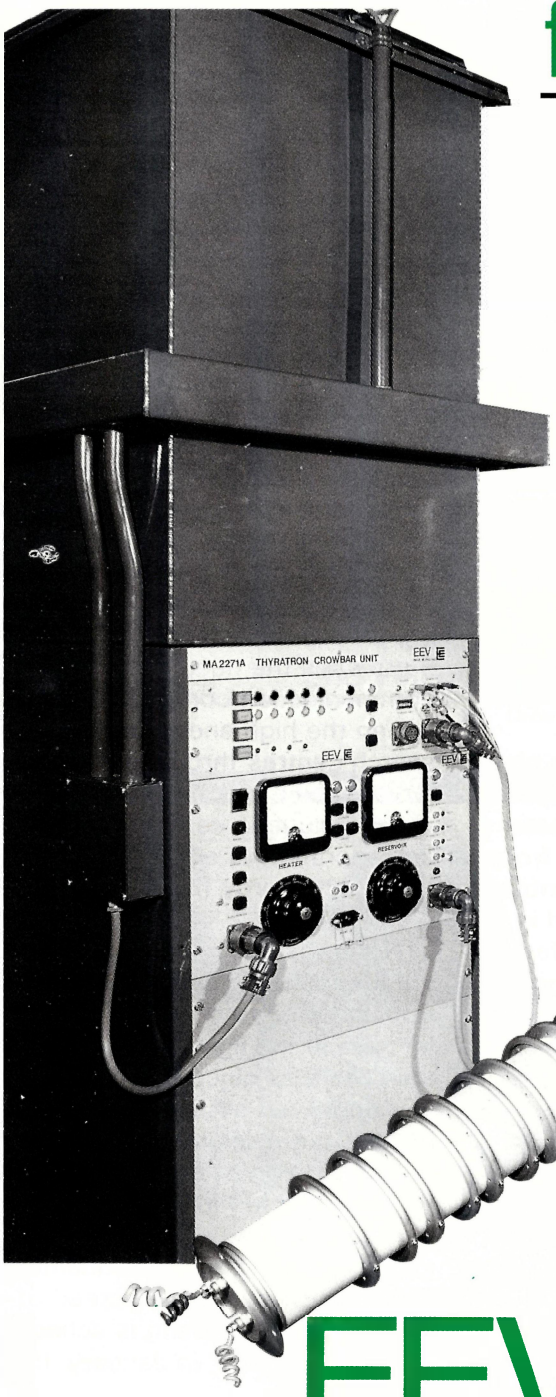
INTERNATIONAL COLLABORATION Panelling

At the meeting of the International Committee for Future Accelerators (ICFA), in Geneva in July, Chairman A.N. Skrinsky of Novosibirsk reviewed ICFA progress, particularly the activities of the specialist Panels which pursue specific Committee objectives in guiding worldwide collaboration in high energy physics.

In Instrumentation, Innovation and Development, the Panel's fourth Instrumentation School was held in Trieste earlier this year. The next will be held in February 1993 in India (as previously agreed), the venue being Ootacumund in the south of the country, where the Tata Institute for Fundamental Research (Bombay) operates a cosmic-ray station which can provide the necessary technical infrastructure. The Panel also supported a regional workshop to be held in Dera Ismail Khan, Pakistan, in January 1992.

In Beam Dynamics, workshop subjects have included Collective Effects of Short Bunches (KEK, Japan, September 1990) and Beam-Beam and Beam Radiation Interactions; High Intensity and Nonlinear Effects (UCLA, May 1991), the latter in conjunction with the Acceleration Technology Panel. The location and topics of a second Beam Dynamics School and of future workshops (on High Performance Collider Issues and on Nonlinear Dynamics of Single Particles) are being reviewed in consultation with V. Balakin (Novosibirsk), Chairman of the Acceleration Technology Panel.

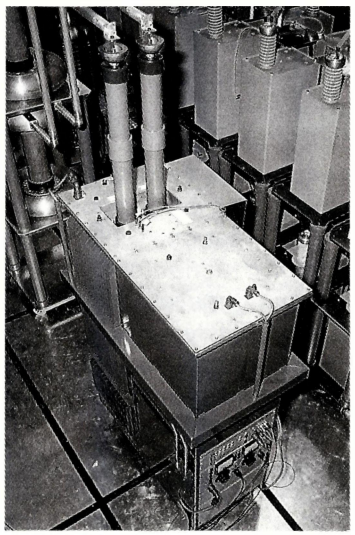
New High Voltage 160kV Thyratron Crowbar Protection Unit from EEV.



Energy diversion is vital for the protection of high power microwave devices operating from DC power sources. At the heart of the EEV crowbar system is a multigap double cathode ceramic thyratron. The complete unit is designed for operation up to a maximum of 160kV DC, using an 8 gap tube. For economic performance at lower voltages, thyratrons with a smaller number of gaps can be used.

The EEV thyratron based crowbar system offers the following benefits:

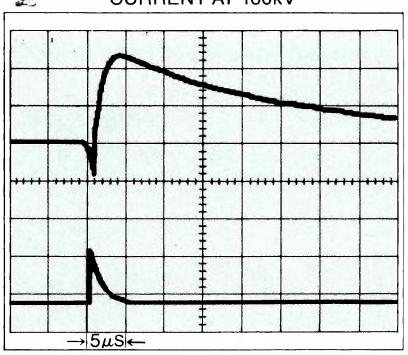
- 100% reliability of firing – the system is fail safe.
- Internal detection of load faults provides self triggering, in addition to external optical triggering.
- Large dynamic range – the system operates from 10% to 100% of the rated voltage.
- Sub-microsecond trigger delay – the thyratron is switching current half a microsecond after the fault condition occurs.
- Very low prefire rates – current operating experience is less than one prefire per week.
- Compactness – the system is fully enclosed in an oil filled tank.
- Cost competitive with systems based on other switch technologies.



EEV's TEST FACILITY
The thyratron crowbar unit being tested on EEV's 200kV 4μF capacitor bank.

8 GAP
THYRATRON
CX2098B

FAULT CURRENT AND THYRATRON CURRENT AT 160kV



THYRATRON CURRENT 10kA DIVISION

FAULT CURRENT 10kA DIVISION

EEV Thyratrons

For further information, contact Peter Maggs

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CANADA: EEV Canada Ltd, 67 Westmore Drive, Rexdale, Ontario M9V 3Y6. Telephone: (416) 745 9494 Telex: 06 989363 Fax: (416) 745 0618
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Another joint venture by the Beam Dynamics and Acceleration Technology Panels, this time also joining forces with the US Superconducting Supercollider (SSC) Laboratory, is the workshop on Effects of Errors in Accelerators, their Diagnosis and Correction, in Corpus Christi, Texas, preceding the major SSC Symposium this October.

In Superconductivity and Cryogenics, the Panel membership has been reorganized to cover radiofrequency cavities and high temperature superconductivity as well as the traditional areas of magnets and associated cryogenics. A new draft of an ICFA standard for superconducting wire and cable for accelerator magnets is being examined.

ICFA is also looking to promote practical applications and spinoff from high energy physics. Despite the successes of the specialist Panel idea in other areas, it was felt that some other solution should be found. Experts in different fields have been nominated to look at ways of spreading the message.

A regular and highly influential item in the ICFA calendar is the Seminar on Future Perspectives. After the 1990 meeting in Protvino, near Moscow, (January/February, page 5), the next venue will probably be DESY, Hamburg, in 1993.

Speaking to the *CERN Courier*, Skrinsky underlined the wisdom of the recommendations ICFA made last year in Protvino.
(These are ICFA –
– expresses its strong support for the ongoing efforts towards extensive international collaboration for the construction and exploitation of the next generation of high energy hadron colliders, as well as R&D work for both these accelerators and for the projected electron-positron linear colliders;
– encourages the high energy physics Laboratories in the different regions of the world (a) to increase the participation of scientists from the advanced developing countries both in research activities and in schools, workshops and conferences, and (b) to help in strengthening or establishing an adequate infrastructure for particle physics research and/or applied accelerator facilities in those countries;
– recommends that both universities and Laboratories establish courses in accelerator physics at undergraduate and graduate level in view of the growing use of accelerators in industry and in medicine, as well as for pure research;
– requests HEP specialists to publish their research work, especially experimental and technical, in refereed journals and not only in the proceedings of conferences and workshops, and encourages the modernization of the related journal technology to facilitate the publishing process for authors;
– stresses the need for improved communication computer links between the high energy physics research centres throughout the world; and
– will include in its future activities consideration of all colliders and very high energy fixed-target accelerators.)

Notwithstanding this wisdom, ICFA agreed at Geneva that it was opportune to review its global objectives in the light of the considerable changes since its charter was last approved by the Particles and Fields Commission of the International Union of Pure and Applied Physics (IUPAP) in Kyoto in 1984. To achieve this, ICFA decided henceforth to meet more frequently, probably twice a year instead of once. Its next meeting is scheduled for Dallas, Texas, in January 1992.

International Committee for Future Accelerators (ICFA) delegates outside Geneva's International Conference Centre for their meeting in July during the recent Joint International Lepton-Photon Symposium and Europhysics Conference on High Energy Physics (September, page 1). On the right is a scale model of the L3 experiment at CERN's LEP electron-positron collider.

(Photo CERN HI53.7.91/25a)

FACULTY POSITION
EXPERIMENTAL PARTICLE PHYSICS
AT THE SSC
PENN STATE UNIVERSITY

The experimental particle physics group at Penn State University is planning a significant increase in its involvement at the Superconducting Super Collider (SSC). Applications are invited for a seniour faculty position. Major facilities, including a VAX cluster, electronics laboratories and shop, on-line data acquisition facility, and mechanical shop and assembly areas are in-place and available for SSC-related research. Applicants should have Ph.D. degree in physics and considerable experience in experimental high energy physics. An on-going presence and/or experience at an existing high energy collider facility is desirable. Send application, curriculum vitae and names of at least four references to

Professor Howard Grotch
Head, Department of Physics
Penn State University
Box SSC
104 Davey Laboratory
University Park, PA 16802, USA

Applications received by January 15, 1992 will be assured of consideration. However, applications will be considered until the position is filled.

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Université de Montréal

Professeur ou professeure en physique des particules

Le **Département de physique** de la Faculté des arts et des sciences sollicite des candidatures pour un poste de professeur pour son groupe de recherche en physique des particules élémentaires expérimentale. Ce groupe poursuit actuellement des expériences au CERN (OPAL), à TRIUMF (RMC) et il est impliqué dans des études de recherche-développement en vue d'une participation à des expériences sur le LHC.

Le candidat ou la candidate de niveau professeur adjoint devra poursuivre une carrière internationale active en physique expérimentale des hautes énergies, pouvoir travailler en français, enseigner aux trois cycles et encadrer des étudiants de M.Sc. et Ph.D. Toute candidature exceptionelle de niveau plus senior pourrait être considérée.

L'entrée en fonction devrait avoir lieu au plus tard le 1er juin 1992. Les personnes intéressées doivent soumettre leur curriculum vitae, des tirés-à-part de leurs plus récentes publications et s'assurer que trois lettres de recommandation soient envoyées directement, le tout **au plus tard le 1er mars 1992 au:**

Dr Jean-Robert Derome, directeur
Département de physique
Université de Montréal
C.P. 6128, succursale A
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Research Associate
Experimental High Energy Physics

State University of NewYork at Stony Brook

Applications are invited for postdoctoral research associate positions to work on SSC detector design and R&D, and the DO detector at Fermilab. The positions offer opportunities for both hardware and software activities. Stony Brook High Energy Group is involved in construction and commissioning of the DO detector, which will have its initial physics run in early 1992.
We are also actively participating in the design of a new major detector (GEM) at SSC.
We are looking for candidates who would contribute substantially to this effort - on physics goals, hardware specifications and simulation efforts.
Participation in DO physics is expected, particularly after preparation of the technical proposal for GEM.
Applications, including vitae and three letters of reference, should be sent to

Professor Mohammad Mohammadi, Dept. of Physics, SUNY at Stony Brook, Stony Brook, NY11794 - 3800.

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Physics monitor

Total reaction rate (cross-section) for proton-proton and proton-antiproton reactions, where the latest result from Fermilab, probing a new energy region, suggests that the rate of increase with energy might not be as rapid as was originally thought.

Elastic scattering

With very few unexplained results to challenge conventional ideas, physicists have to look hard to search for gaps in understanding.

An area of physics which offers a lot more than meets the eye is elastic and diffractive scattering – where particles either 'bounce' off each other, emerging unscathed, or just graze past, emerging relatively unscathed.

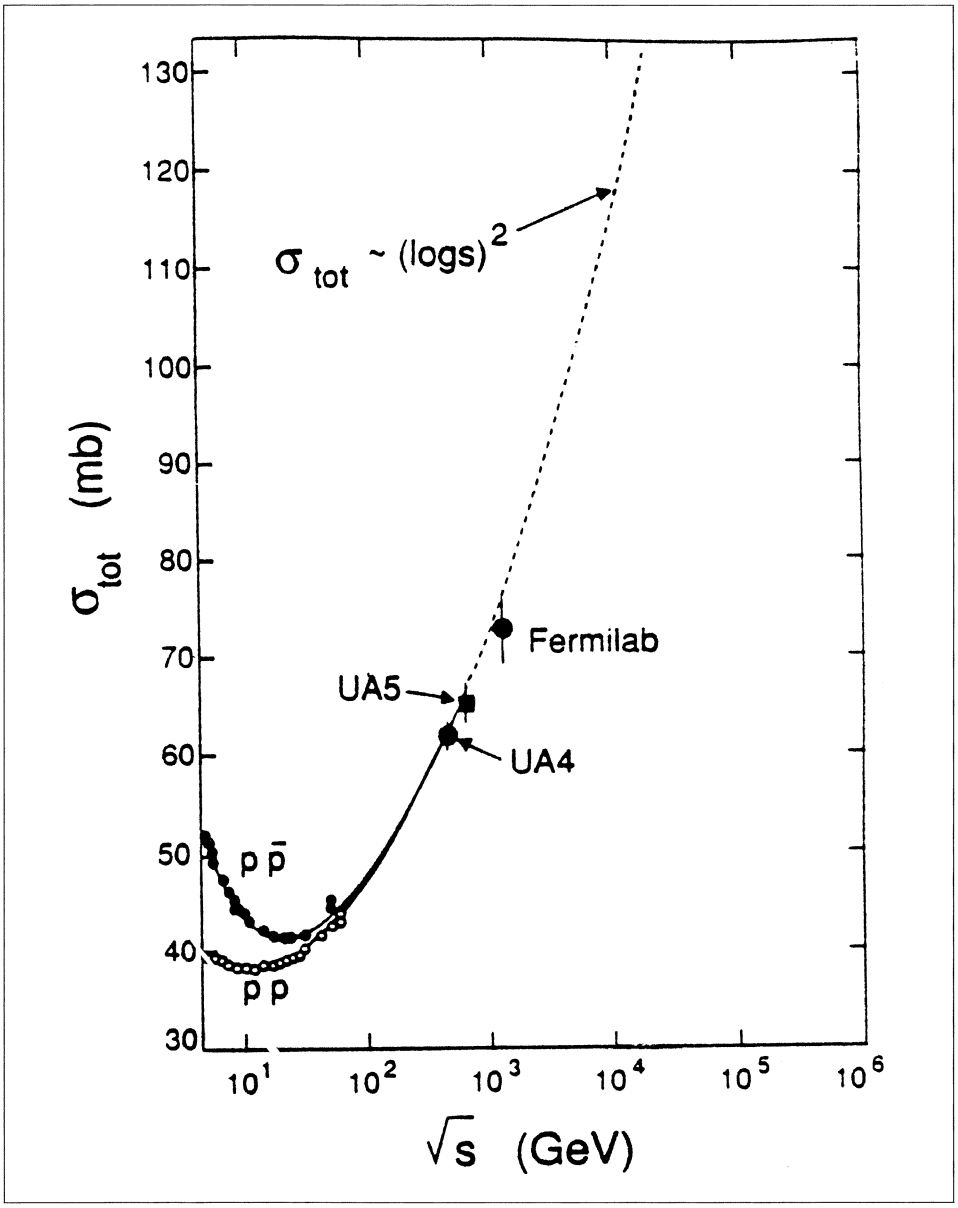
The 'Blois' workshops (named after a favourite French venue) provide a regular focus for this unspectacular, but compelling physics, attracting highly motivated devotees.

Unfortunately solid new results in this area are rare these days, but this year's meeting in La Biodola, Sardinia, had new experimental results to digest. The proton-antiproton reaction rate (total cross-section) at 1800 GeV collision energy, measured by two groups at Fermilab, is smaller than some people expected.

This reaction rate depends on the imaginary part of the forward scattering amplitude. Measurements at 1800 GeV moreover suggest the ratio of the real and imaginary parts (rho) of this amplitude to be smaller than expected.

Attention also focused on the 'Pomeron' – the mechanism driving elastic scattering, and the 'Odderon' – an analogous way of explaining the continued difference between proton-proton and proton-antiproton behaviour at high energies.

With the prospect of a new energy scale opening up with the next generation of proton colliders, J.D. Bjorken argued at the Blois meeting that the programme at the planned US SSC Superconducting Supercollider is too narrowly focused on the high energy frontier, especially the 'Higgs' mechanism of electroweak symmetry breaking, at the expense of unbiased 'survey physics'.



Low energy effects might not seem the most exciting part of a new high energy programme, but sensitivity also increases with energy. Bjorken is pushing for a long spectrometer to study soft physics at the SSC.

(The report of the July meeting of the SSC Program Advisory Committee says – 'At this time an experimental collaboration does not exist and the cost of the fully instrumented detector is too high for the initial SSC program. However in view of the possible interest in this type of experiment at some stage of SSC operation the Committee supports the study of a suitable 1-kilometre enlarged tunnel in the

SSC design where a wide class of experiments such as this one could be carried out.)

On the theoretical side, the Blois meeting could report much progress in the kinematic region where the perturbative field theory (QCD) of quarks and gluons is not directly applicable.

In experiment, one challenge is to find whether the Odderon really exists. Because the Pomeron normally dominates, this means looking at reactions where the Pomeron is absent – pion conversion to rho mesons in fixed target work, for example.

In total cross-sections, the new 1800 GeV proton-antiproton data from Fermilab is the latest episode in a long saga. Before 1968, the general belief was that total cross-sections were smoothly approaching some kind of constant asymptotic limit. CERN's Intersecting Storage Rings, opening up a new energy region, quickly showed otherwise. This surprise was underlined by new understanding, showing that the behaviour increased at the maximal rate allowed by a healthy theory, going as the square of the logarithm of the collision energy.

Another widespread belief was that particle and antiparticle differences would iron out at higher energy. At CERN's proton-antiproton collider, the UA4 experiment's rho result suggested that things could be more complicated.

This measured value can be accommodated either by anticipating a rapid increase in the proton-antiproton reaction rate beyond the CERN Collider energies – a 'New Threshold' scenario – or by calling up the Odderon. Clearly the higher energy results from the Tevatron are crucial in choosing between these two alternatives.

However measuring a total cross-section at a collider is not that easy. At Fermilab, experiment E710 and the CDF collider now agree that the proton-antiproton total cross-section is about 72.6 ± 3.5 millibarns at 1800 GeV. This value certainly eliminates the New Threshold Scenario and is even hard to achieve with Odderons. The extrapolation from the ISR to the Tevatron now also looks different.

Even more difficult to measure is rho. The scattering angles are so small that the scattered beam overlaps the divergence of the unscattered particles. Special detectors ('Roman pots') extend into the beampipe.

It is not easy for the central UA4 and E710 results to coexist, although some theorists have risen to the challenge. With the situation so uncertain, elastic scattering will continue to draw an appreciative audience.

From Elliot Leader

The ARGUS experiment at DESY's DORIS II electron-positron collider has supplied useful limits on the mass of the tau neutrino.

Tau neutrino no heavyweight?

The decay patterns of the Z particle – the electrically neutral carrier of the weak force, dominated by the information from the four big experiments – Aleph, Delphi, L3 and Opal – at CERN's LEP electron-positron collider, have shown that only three types of light, conventional neutrino can exist.

This important result confirmed what many physicists had long hoped for – a neat picture of fundamental interactions in terms of six types of quark, grouped pairwise with three types of weakly interacting particles (leptons).

But particle physics – the study of the infinitesimally small – has become intrinsically linked with

People and things

astrophysics and cosmology – the study of Nature on the widest possible scale. An example was the pre-LEP prediction, based on the primordial nucleosynthesis of light elements (deuterium, helium and lithium), that there is not much room for more than three kinds of light neutrinos (June 1990, page 3).

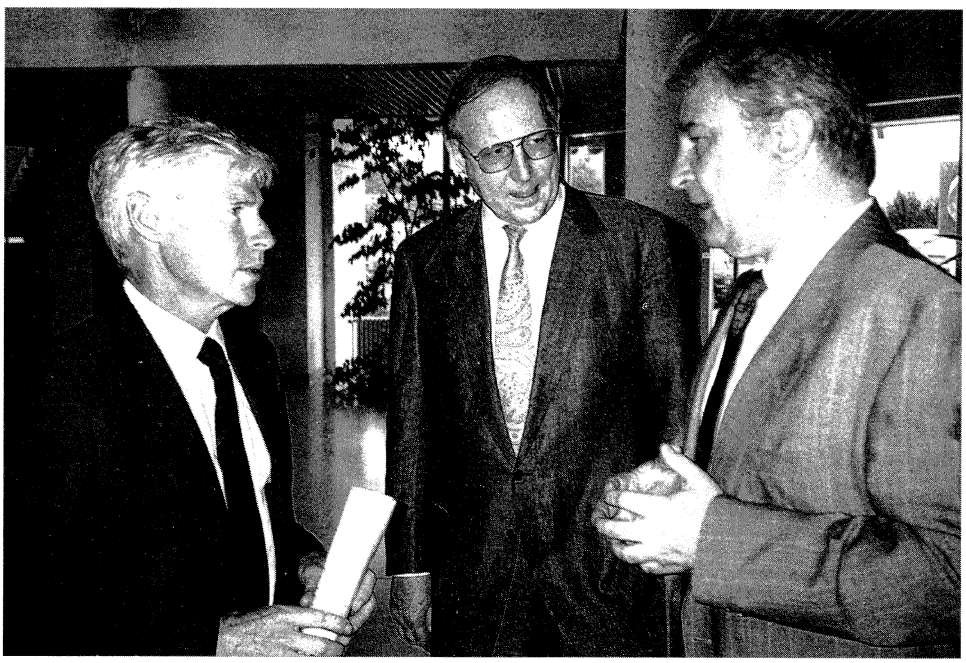
In this context, 'light' means much less than 1 MeV. Heavier neutrinos would have behaved differently at the epoch (when the Universe was about 200 seconds old) when protons and neutrons began to fuse together to form light nuclei.

Earlier, neutrinos were in thermal equilibrium, so that, for example, neutrino-antineutrino pairs constantly formed electron-positron pairs and vice versa. However when the Universe cooled to a temperature of the order of a few MeV, it became 'transparent' to weakly interacting light neutrinos, who were relegated to an essentially spectator-like role.

However a massive (multi-MeV)-neutrino would have acquired an appreciable energy density, affecting the subsequent production of light nuclei.

From these arguments, the Chicago-based quartet of Edward Kolb, Michael Turner, A. Chakravatory and David Schramm have examined how such a multi-MeV neutrino would have affected the relative abundances of light elements. With the plausible assumption that the tau neutrino lives for longer than about a second, they conclude that this particle (the only neutrino not yet constrained by experimental limits to be light) has either to be lighter than 0.5 MeV or heavier than about 25 MeV.

With the ARGUS experiment at DESY's DORIS electron-positron collider saying that the tau neutrino has to be lighter than 35 MeV (September, page 25), the particle doesn't have that much room to move. If the cosmologists' argument is right and the experimental limit can be reduced to 25 MeV, then a tau mass above 0.5 MeV would be ruled out.



At the opening of the European Space Agency's exhibition at CERN's Microcosm Expo Centre in July – (left to right) ESA Science Programme Director Roger Bonnet (wearing CERN tie for the occasion), ESA's ESTEC research and technology centre (Noordwijk, Netherlands) Scientific Director Martin Huber, CERN Research Director Pierre Darriulat.

Meetings

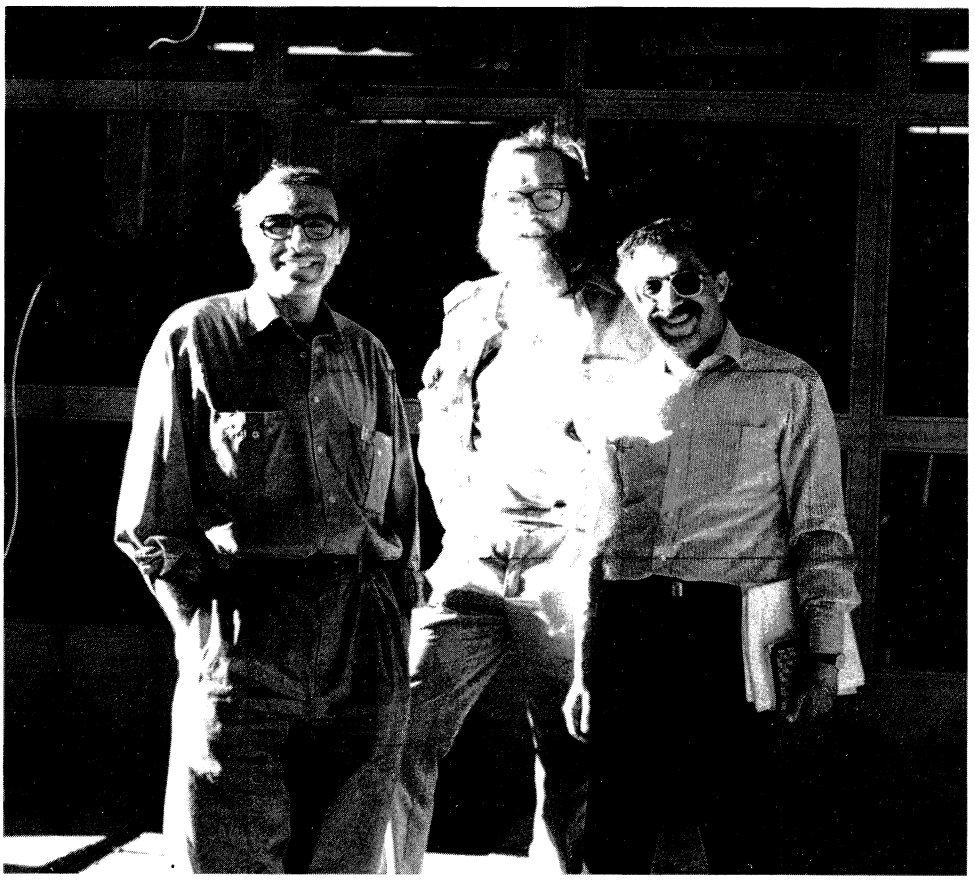
The Advanced Study Institute on Techniques and Concepts of High Energy Physics, sponsored by NATO, the US Department of Energy, the US National Science Foundation, Fermilab and the University of Rochester, will be held in St. Croix, US Virgin Islands, from 15-26 July 1992. Further information from C. Jones, Dept. of Physics and Astronomy (ASI-92), University of Rochester, Rochester, NY 14627, USA. E-mail (bitnet) connie at uorhep or ferbel at fnal (decnet) urhep::connie

The 1992 Gordon Research Conference on Particle Physics in the 90s will be held from 13-17 July 1992 at the Proctor Academy, Andover, New Hampshire. The organizing committee is chaired by John Elias at Fermilab.

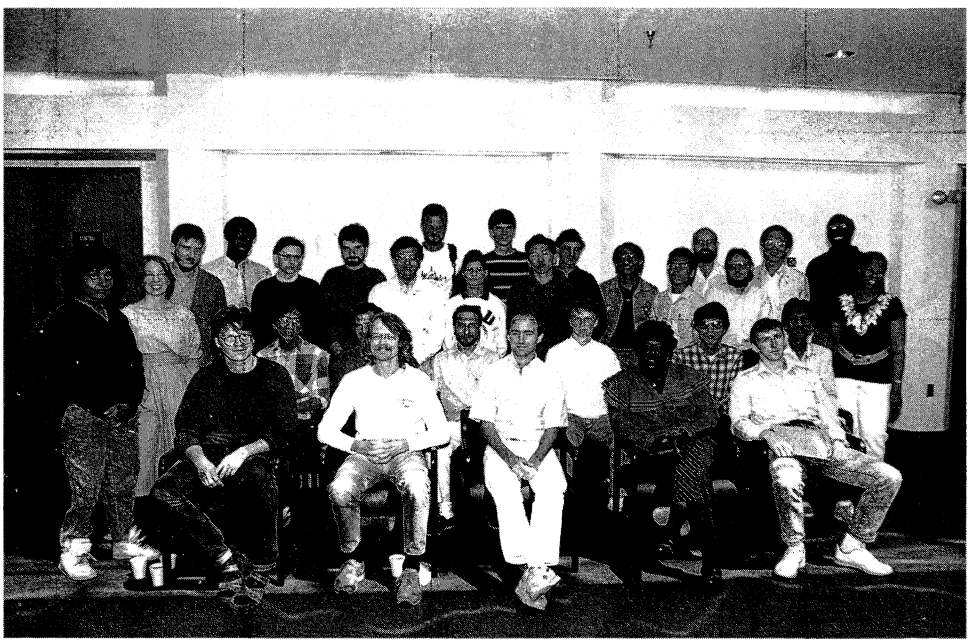
CEBAF graduate programme completes sixth summer

Hampton University Graduate Studies (HUGS) at CEBAF, a summer program in electromagnetic nuclear physics held at the Continuous Electron Beam Accelerator Facility, Newport News, Virginia, has completed its sixth year. Some 26 second- and third-year graduate students from 21 universities participated and earned academic credit. Lecturers included Glennis Farrar (Rutgers), M. Frank (Kent State),

▼ *CERN Theory Division Leader John Ellis outside the Physics Department of the Sharif University of Technology, Teheran, flanked by Department Chairman Farhad Ardalan (left) and Hussein Arfaei. The present research is quite theoretical, reports Ellis, but there are ideas to send research students to Europe to boost experimental and phenomenological work.*



▼ *A university graduate studies program* ▼ *now a regular feature at CEBAF, the Continuous Electron Beam Accelerator Facility, Newport News, Virginia. This year 26 second- and third-year graduate students from 21 universities participated and earned academic credit.*



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Superconducting Super Collider, (USA)
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TRIUMF Laboratory, (Canada)
M. K. Craddock

Late news – new funding for KAON project in Vancouver

The Canadian government has offered $236 million dollars for the KAON particle beam factory project at the TRIUMF Laboratory in Vancouver. This represents a third of the project's cost, and matches an earlier offer from the regional British Columbia government. More news in our next issue.

J. Gates (Maryland), D. Kusnezov (Michigan State), and W. Parke (George Washington).

Proton structure book

A timely addition to high energy physics literature is The Structure of the Proton by R.G. Roberts (Cambridge University Press 1991, ISBN 0-521-35159-6).

The HERA electron-proton collider at DESY will soon begin analysing the structure of the proton with a resolution roughly an order of magnitude better than existing experiments. Although the basic 'parton model' picture of this structure is rather simple and intuitive, the actual process of extracting and quantifying the information from experiment requires a complicated mathematical framework.

This book introduces the intricacies of proton structure physics. Starting from the basic physical picture, the author gently introduces the refinements – structure functions, sum rules, scaling violations, radiative corrections and so on – to produce in the end a comprehensive handbook. Written by one of the subject's leading experts, it comes as no surprise to find that all the important theoretical and experimental results to date are included. Together with a beautifully clear writing style, this makes it an invaluable purchase for beginners and experts alike.

Preparing for LHC experiments

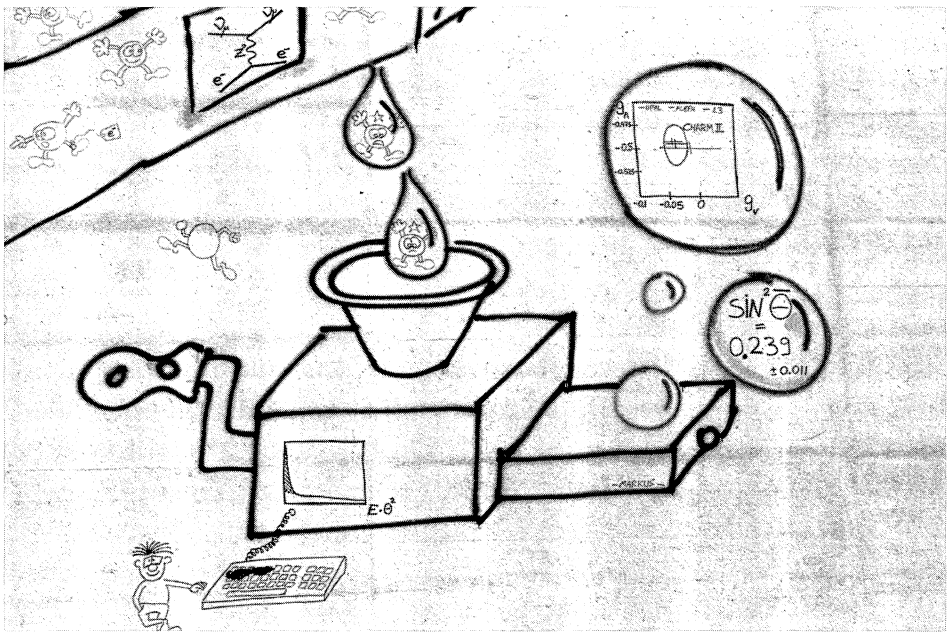
With research and development work pushing ahead for the experimental programme at the proposed LHC proton collider in CERN's LEP tunnel, attention is also turning to preparations for the experiments themselves.

Rather than rushing for Letters of Intent (LoIs) for specific experiments, the immediate plan is for the R and D programme to continue to roll. LoIs will be invited next year, while a new LHC Experiments Committee will be set up to recommend by the end of 1992 those projects meriting a full technical proposal.

To prepare for the LoI stage, a 3-4 day meeting will be convened early next year, covering all aspects of the LHC physics programme and its attendant detector scenarios, as a platform for detector study groups. As a lead-up, a one-day preparatory meeting organized at CERN on 28 October covers the latest developments in LHC machine design and preparations for the LHC experimental programme, including detector R and D, detector magnet design and plans for experimental areas.

Edwin M. Macmillan 1907-91

Edwin M. Macmillan died on 7 September, age 84. In 1940 (with Philip Abelson) he discovered neptunium, the first transuranic artificial element, and in 1951 shared the Nobel Chemistry Prize with Glenn Seaborg for their pioneer work on transuranic elements. In particle physics, he was best known for the invention of 'phase stability', demonstrated at Berkeley in 1946 and incorporated in the synchrocyclotron concept. From 1958 to his retirement in 1973 he was director of the Lawrence Berkeley Laboratory. A full tribute will be included in our November edition.



The tradition of 'tagging' the walls of CERN experimental halls which housed bygone neutrino experiments was started by WA1 in 1984. The picture shows a detail from CHARM II's contribution to the CERN landscape after it closed down this year (page 5).

(Photo CERN HI 14.8.91)

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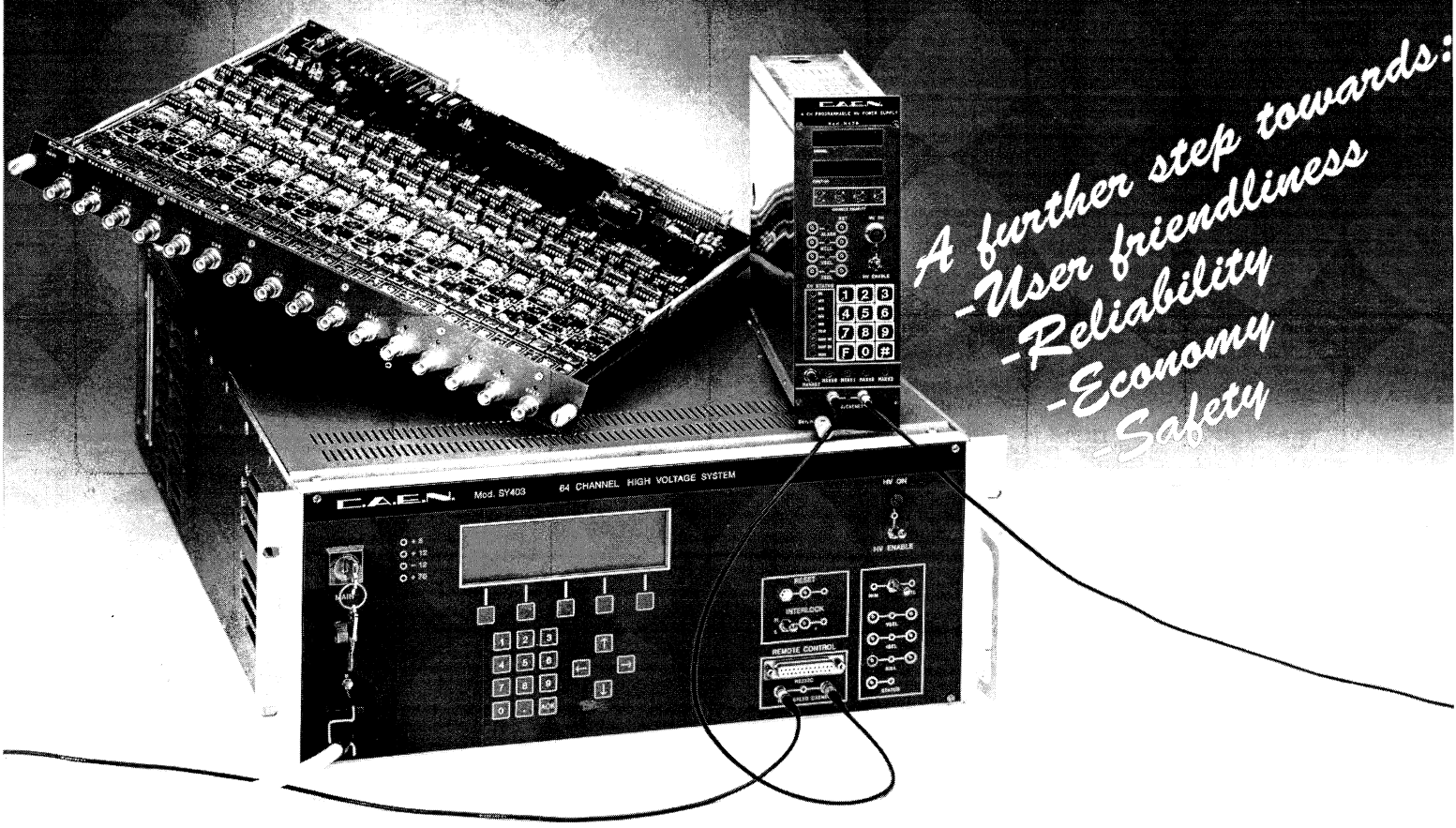

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- 16 H.V. channels per board
- ±3 kV/3 mA and ±600 V/200 μA channels available
- Sophisticated hardware and software protections
- Interlock and password facilities
- Local control both via front panel keyboard and display and RS 232 C port

N 470
4 Channel programmable High Voltage Power Supply

- Two unit wide Nim module
- Output voltage up to ± 8kV, output current up to 3 mA
- Presettable MAX HV output via front panel trimmer
- Independent positive or negative polarity
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Both units can be remotely controlled by CAMAC, VME and PC via High Speed CAENET

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Technopolis Thoiry

Geneva Moves With The Times

Geneva has been closely linked to science from the time it hosted crucial discussions on links between such diverse phenomena as light, chemical reactions and magnetism. Indeed, the city became the home of one of Europe's first major experimental facilities — a giant electrochemical pile designed to test Ampere's theories. This was built by de Saussure two decades after a visit by Volta to demonstrate a more famous, but much smaller, pile on his way to impress Napoleon.

An International Role

Geneva's role in providing a testbed for unified theories of matter continues to this day at CERN where the LEP collider probes nature at the 10^{-18} metre scale by colliding electrons and positrons circulating inside a high vacuum beam pipe buried up to 100 metres below the Swiss and French countryside in a 27 kilometre circular tunnel.

CERN was conceived by scientists and politicians in the late-1940's as a step on the road to post-war reconciliation *via* a major collaboration on the neutral ground of pure research in a region with a long history of internationalism. With a staff of 3000 and a budget of some 900 million Swiss francs to provide facilities for scientists from 300 institutes, CERN welcomes 6200 visitors each year.

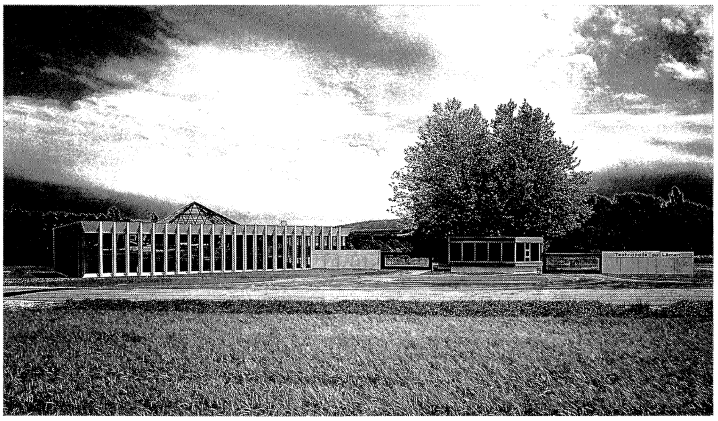
The Technopole Interface

Geneva continues to adapt its role as we move towards the 21st Century. Science parks represent one development and there are now about 300 in the industrialized world. In offering a homogeneous blend of activities and facilities, they generally aim to enhance synergies in an increasingly competitive world.

Unique among the science park concept is the Technopole approach where an outer circle of commercial, governmental and institutional interests come together to promote an inner core of activities providing interfaces between science, technology, new businesses, and higher education. Each Technopolis thus comprises a homogeneous blend of facilities and ancilliary services.

The Geneva region's Technopolis is situated just across the Franco-Swiss border from the main CERN campus. The 27 hectare green field site on the outskirts of the village of Thoiry is therefore ideally located to interface with the international physics community. Being only five kilometres by road from Geneva's international airport and main line station is an invaluable advantage.

Looking across the main CERN campus to Geneva from Technopolis Thoiry, outlined as an artist's image.



The Opus One building at Technopolis Thoiry.

Focussing on Applied Physics

LHC, CERN's next major collider, proposed for the LEP tunnel, follows on from past achievements in calling for state-of-the-art superconducting magnets, advanced materials, sophisticated vacuum and cryogenic systems, high power electronics, and a wide range of computer-based facilities to serve all aspects of the machine — from resource management to the imaging of particle collisions in its mega-detectors.

Technopolis aims to allow industry and institutes to participate in, and contribute to, rich scientific and technical environment by serving as a closeknit interactive base for specialist organizations. In addition to enjoying a convenient window on CERN's extensive sub-contracted requirements, they will be able to arrange collaboration on a formal basis. Technopolis is also working to establish an Institute to provide an interface in applied physics between teaching and research staffs, postgraduates and high calibre technicians coming from industry and R. and D. centres.

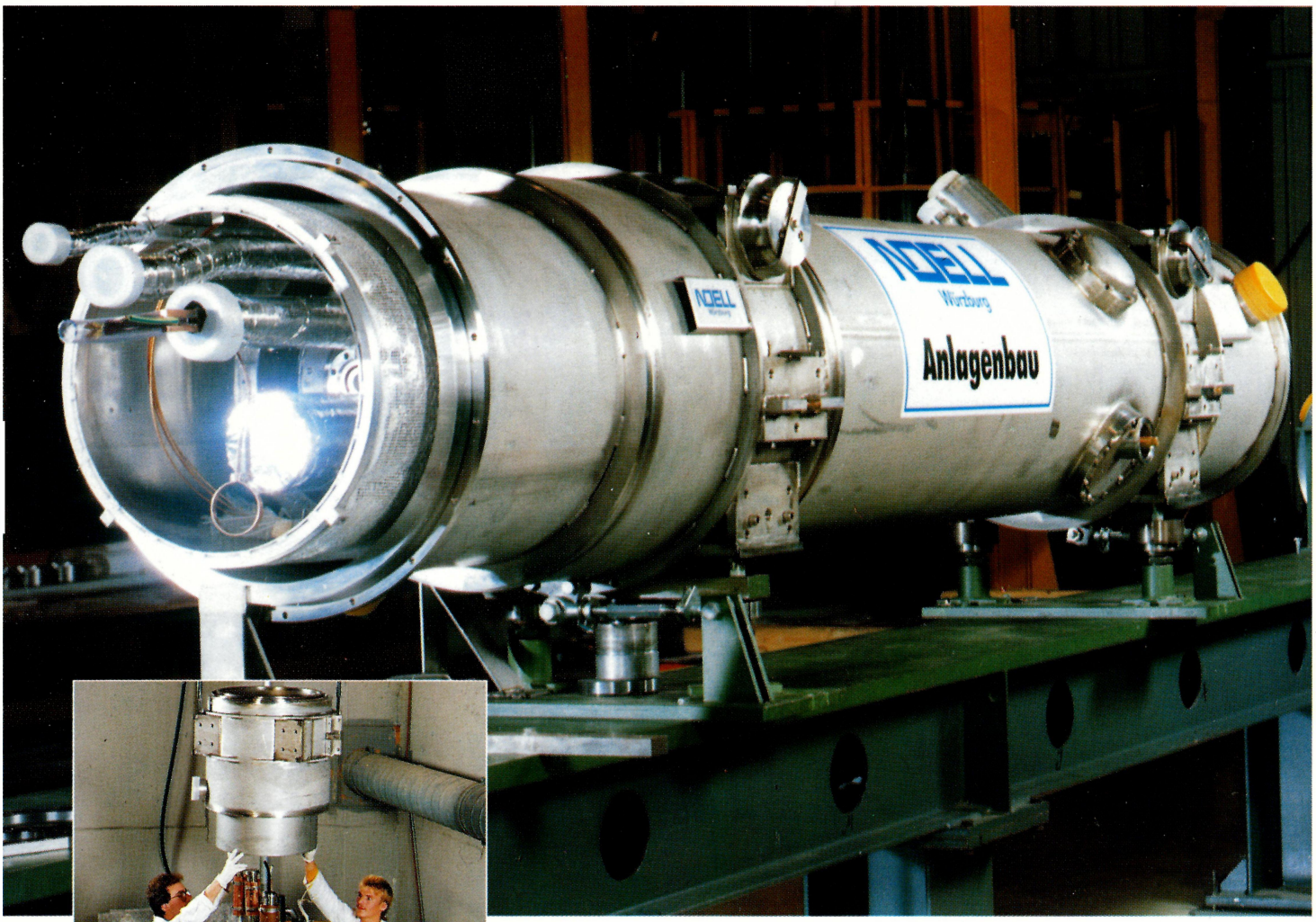
A Superb Environment

Robert Hinterberger, Director of a Technopolis Thoiry based computer software company, places great importance on the "perfect working environment". This will continue to be preserved in a balanced development comprising space reserved for accomodation, technical and commercial companies, the technological institute, small scale R. and D. units, and hotels and conference services.

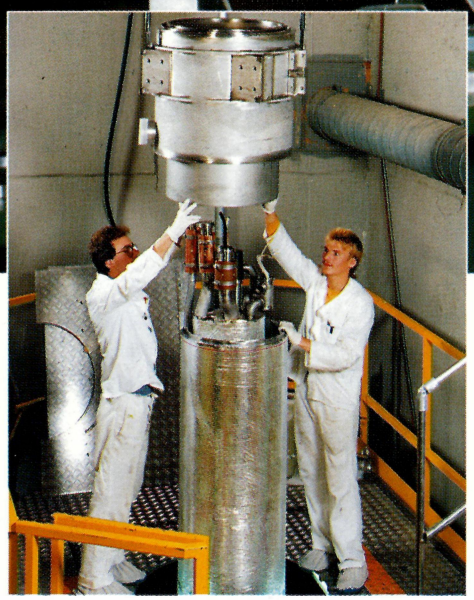
By the same token, while Mr. Benier, the Mayor of Thoiry, is "obviously interested in promoting employment opportunities" he is "also concerned that we preserve the quality of our local environment". Hence recent agreements for a national park in the Jura mountains behind Thoiry, consolidation of road access from Switzerland through to the French motorway system, a cultural centre, a second international school, and the imminent construction of a major world-class shopping centre.

120 quadrupole cryostats

for the HERA storage ring



Cryostat on the measuring platform



Cryostat being manufactured

The industrial production of storage ring components presents a major challenge. NOELL GmbH, Würzburg, Germany took on this challenge by supplying 120 quadrupole cryostats for the HERA storage ring on schedule and to the full satisfaction of the client. NOELL is currently manufacturing 4 superconducting dipole prototypes.

The take over of the magnet engineering sector of the ABB company has helped NOELL to extend its activities in this field.

NOELL also supplies components for servicing and maintenance of storage rings and for fusion reactors; these include manipulators Tokomak in Princeton, USA and for JET in Culham, UK as well as positioning manipulators for the LEP magnets in Geneva, Switzerland. Contact us if you require any components for particle research and for fusion engineering.

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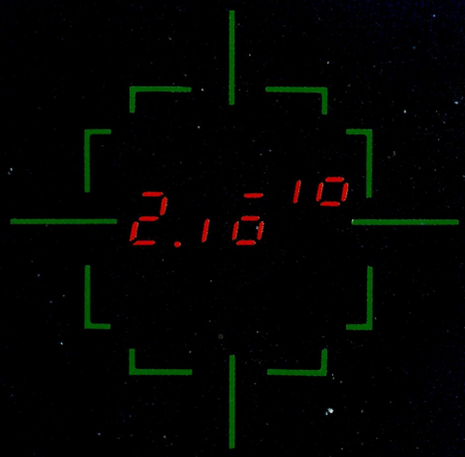

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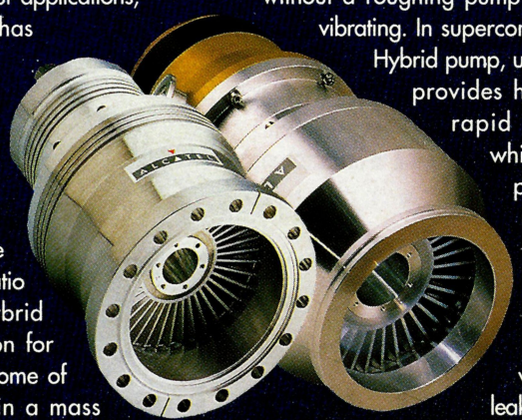

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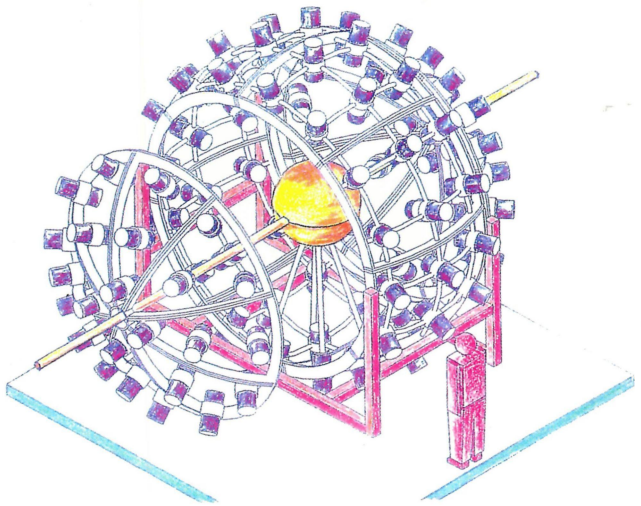
Scintillator WORLD

News and views from NE Technology

NE's DEMON detectors

The Franco/Belgian project teams building DEMON, Europe's latest modular neutron detector, have decided that all their neutron detectors will consist of NE 213-filled cells.



Computer-generated representation of DEMON.

After two years of progress, working in close contact with scientists from both teams, deliveries of the first major consignments have been completed, with 12 detectors going to France and 18 to Belgium.

Success depended upon optimising the mechanical properties of the cells to maintain excellent pulse shape discrimination, whilst maximising the efficiency of neutron detection. These characteristics help the neutron energy and angular distribution measurements to be performed under "the best experimental conditions".

When DEMON, complete with 96 neutron detectors, has been assembled it will be operated at the cyclotron facility at Louvaine-la-Neuve and also at GANIL (Caen). The modular construction of the detectors will ensure ease of installation and rapid commissioning.

The possibilities for nuclear physics at DEMON include; identification of different reaction channels for high energy neutrons, how the excitation energy in neutron reactions is shared and neutron interferometry.

ALL SYSTEMS GRO!

Celestial gamma rays are emitted by some of the most powerful, and strange, sources of energy in the universe. They reveal the interactions of subatomic particles with matter and radiation to increase our knowledge and understanding of phenomena such as neutron stars, quasars and the mysterious gamma ray bursters.

With the successful launch of the Gamma Ray Observatory (GRO) from Houston on 23rd April 1991, sources 10 to 50 times fainter than previously observable can now be detected.

Gamma ray energies between 1MeV and 50MeV are observed by the Imaging Compton Telescope (COMPTEL), whilst the Energetic Gamma Ray Experiment Telescope (EGRET) covers the 50MeV to 2000MeV range. Both telescopes are equipped with anticoincidence detectors supplied by NE Technology.

NE were the only company able to manufacture these large dome-shaped plastic scintillators to the required accuracy. Now their precise Cassini profiles are clearly visible as GRO takes scientific data, orbiting 450km above the surface of the earth.

GRO in orbit.

On top of Gran Sasso

The study of cosmic showers from astral bodies is helping to increase our understanding of the universe and it's origins. Now the Extended Air Shower Array experiment on top of the Gran Sasso tunnel in Italy, (EASTOP), will take this even further. It is designed to determine the cross sectional areas and the entry angles of the most energetic showers.

Using data from a matrix of 400 detectors, made out of 800 × 400 × 400mm sheets of NE 110 it will be possible to deduce the original energy and the azimuthal co-ordinate of the highest energy showers.

Due to the design qualities of the EASTOP array, it can also provide a supplementary level of triggering for MACRO, a major part of the Gran Sasso complex.

British Steel's raw materials stay cool

Radiation detector operating at the entry weighbridge

NE's experience with scintillators benefits many Original Equipment Manufacturers (OEMs), positively influencing their commercial success.

With **British Steel**, the requirement was to prevent radioactive sources of Cobalt or Caesium from inadvertently coming into refineries via the scrap. The solution is to combine a gantry-mounted scintillation detector with a vehicle sensor operating at the entry weighbridges.

The use of such a device offers considerable benefits. It reassures the workforce, by demonstrating that practical steps are in force to prevent any contamination of the plant. If radioactivity were to enter the plant, very large charges for radioactive decontamination and waste disposal could be incurred.

In tests, a 185MBq (5mCi) source of radioactive Caesium within a 30mm lead pot, concealed in a lorry-load of scrap, was easily detected, yet the detector length is only 400mm.

New Agents appointed for France.

NE's new representatives for scintillators in France are **Intertechnique** who purchased **Numelec Instruments** earlier this year. Intertechnique are a leading supplier of nuclear detectors and the only European company designing, manufacturing and supplying the full range; germanium, silicon, CdTe and scintillation detectors, together with NIMs and systems. These are supplied both to end-users and other nucleonic companies. NE's contact is **Marie-Odile Lampert** who is well experienced in the technical and marketing aspects of the business.

Marie-Odile LAMPERT

Douglas R. Ni

Douglas R. Nicoll, Chief Chemist, Edinburgh Laboratories, took his well earned retirement at the end of Ju 1991.

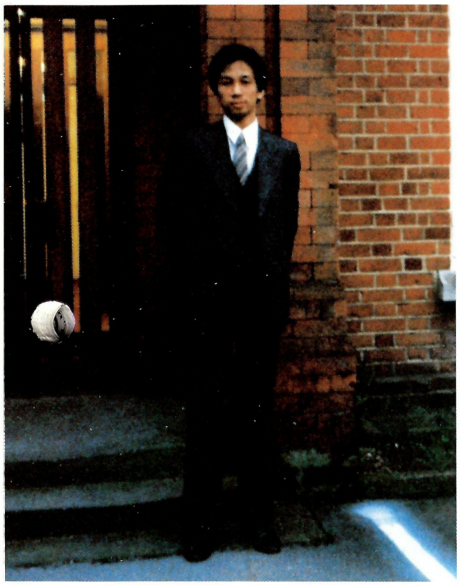
After he joined Nuclear Enterprises (GB) Ltd in 1956, as 'Employee No. 2', Mr. Nicoll supervised all organic scintillator developments. Starting with the original 'oil bath on an electric heater ring' technique, he is

NE TECHNOL

Scintillators in the form of long 'fingers' were recently delivered to CERN. A total of 360 pieces of NE 110, each one 1850 × 14.5 × 10mm were supplied.

The fingers are components of the Omega Spectrometer for use on WA91 ('glue-ball' search) and WA92 ('beauty'

OKEN – creating NE fans in Japan



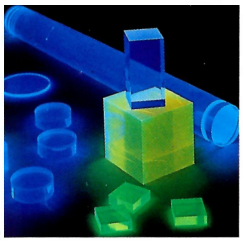
Akio Sakuragi

Ohyo Koken Kogyo Co Ltd (OKEN) has distributed NE Scintillators in Japan since 1979. **Mr. Akio Sakuragi** is the sales representative providing the link between NE and their Japanese customers. He reports that customers and users set exacting specifications and they expect quick deliveries, reasonable prices and of course, high quality.

OKEN stores standard plastic and liquid materials in sufficient quantity to supply them machined, encapsulated or made into detector assemblies. This strategy creates satisfied customers and allows them to compete successfully with both domestic and American suppliers. "As a result", says Mr. Sakuragi, "many new customers are becoming fans of NE".

Scintillator World 1991

Please tick appropriate boxes to indicate your interests



Plastic scintillators

large area ☐
general purpose ☐
fast timing ☐
low cost ☐
high temperatures ☐
special purpose – state application

.....

Liquid scintillators

large volume, low cost ☐
psd types ☐
loaded types ☐

special purpose
– state application

.....

Glass scintillators

Inorganic, multi-crystalline types

ZnS ☐ ZnO ☐

Inorganic, single crystal types

crystal types of interest

.....

oll

the person responsible for developing the refined materials and chemical methods used by NE Technology today – 35 memorable years!

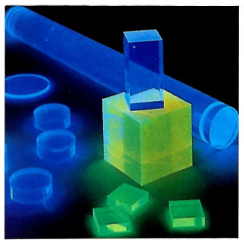
Amongst other things, Douglas now intends to devote more time to his interests as an active member of the Edinburgh Astronomical Society.

We all wish him a long, happy and prosperous retirement... and clear skies!

Douglas R. Nicoll

Scintillator World 1991

Please tick appropriate boxes to indicate your interests



Plastic scintillators

large area ☐
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low cost ☐
high temperatures ☐
special purpose – state application

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large volume, low cost ☐
psd types ☐
loaded types ☐

special purpose
– state application

.....

Glass scintillators

Inorganic, multi-crystalline types

ZnS ☐ ZnO ☐

Inorganic, single crystal types

crystal types of interest

.....

OGY AT CERN

search), and will help in the accurate measurement of the life of both charged and neutral beauty.

Installed behind some 3 radiation lengths of Pb-glass, in a configuration of 2 orthogonal planes, the quality of the fingers is such that the positions of incoming charged particles (arising from the conversion of photons in the Pb-glass), can be localised to +/– 2mm after pulse height analysis.

Bernard French, the contact person for the experiment, expressed his complete satisfaction with the delivery, quality and performance of the NE 110.

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a) to discuss my project ☐

b) to arrange a visit ☐

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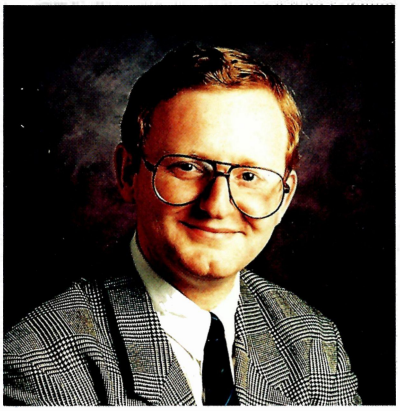
SNIPPETS

- The purchase of **Vinten Analytical Systems Ltd** in February marks an important step in NE's acquisitional growth, boosting turnover in nuclear products by 30%, mainly in Thermoluminescent Dosimetry, Track Etch Dosimetry and medical instruments such as the ISOCAL Dose Calibrator.
- Steel monitoring of scrap in the USA has been made simpler and easier following the introduction of the GR-520 Low Level Radiation Monitor by **Exploranium.** Their system utilises NE plastic scintillator to control traffic lights situated at the weighscales or plant entry point. There are strong economic arguments in favour of such installations. Whilst removal of a contaminated load may cost around $30k, furnace clean-up costs are estimated to be more like $5M to $15M.
- Large scale scintillators using a single photomultiplier tube to cover a detection area of 600 sq cm are now available to special order. Preferential detection of alphas, betas neutrons et al is accomplished by the choice of scintillator materials.

Dr. John Emans

NE announces the appointment of **Dr. John Emans,** BSc PhD, as Chief Chemist and Head of Engineering, Edinburgh Laboratories. John, who has considerable research and industrial experience in the fields of liquid crystalline polyesters and polymer chemistry, commented on his new role in concise terms:



Dr. John Emans

"Strictly applied QA techniques are fundamental to modern chemical processes." In his leisure time John keeps fit on the badminton court and has musical interests which include playing the flute and the clarinet.

We want to hear from you!

These news items and stories are only a brief 'snapshot' of our business, which is providing the best possible goods and services to the markets we address.

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Within a year's span, the number of physicists starting on new projects can be counted in hundreds if not thousands. This means updating our mailing list at regular intervals with the correct type and frequency of information that you require.

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