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Reader service form, page 28.

Nobel Physics Prize 1992

The CERN Courier congratulates Georges Charpak on being awarded this year's Nobel Physics prize for his invention and development of particle detectors, in particular the multiwire proportional chamber (1968). He joined CERN in 1959 and celebrated his 65th birthday in 1989 but continues to be a regular visitor. Full tribute in next month's issue.

Cover photograph: CERN at night - special effects by Gilbert Cachin

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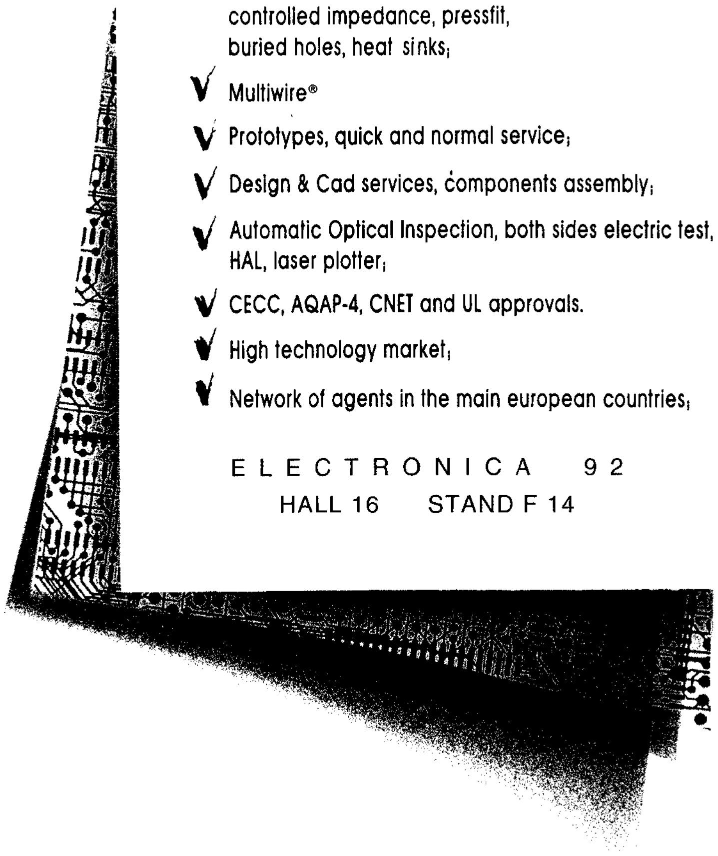

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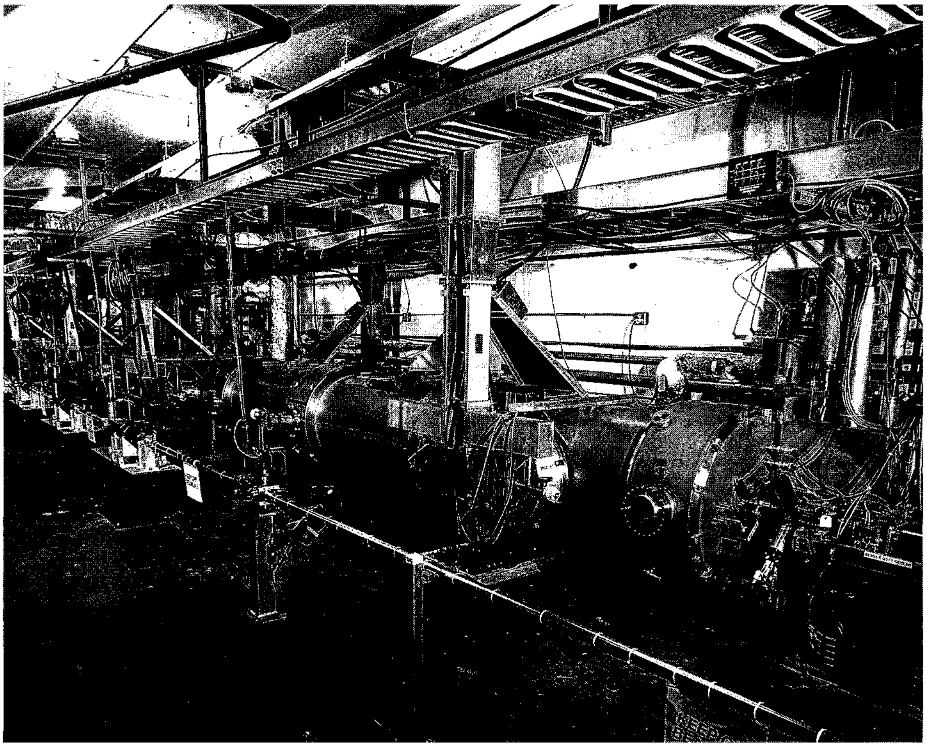
Hamburg Accelerator Conference (2)

Encouraging progress at the CEBAF Continuous Electrom Beam Accelerating Facility based on recirculating linacs. (Photo Frank Hoffman)



From 20-24 July, Hamburg welcomed the Fifteenth International Conference on High Energy Accelerators (HEACC). The first half of a report on this major meeting, covering preparations for the big new proton colliders based on superconducting magnets, and research and development work for future electron-positron linear colliders, featured in our October issue (page 9).

The HEACC Conference traditionally reviews the status of all major accelerator projects whether they are already running like clockwork, still in the construction phase, or waiting impatiently for financial approval.

A key feature of the US high energy physics scene for the 1990s and beyond will be the substantial upgrade around Fermilab's Tevatron. Steve Holmes said its aim is to secure the top quark discovery, double the mass reach for as yet unobserved particles, and move into factory mode for Ws, producing 10^5 per year, and Bs (10^{10} per year).

The first key elements – electrostatic separators – are now running very well with no beam loss due to sparking over 500 hours. The next step is the Linac upgrade to 400 MeV with a side-coupled structure to be commissioned in the Spring. Good news was that construction of the new Main Injector to feed the Tevatron was to begin immediately, having been approved just a few weeks before the conference. Tunneling would start soon and it was hoped that the main injector would be complete in 1997.

On the East Coast of the US, two major accelerator projects, CEBAF and RHIC, are well into their construction phase. Both have unusual features.

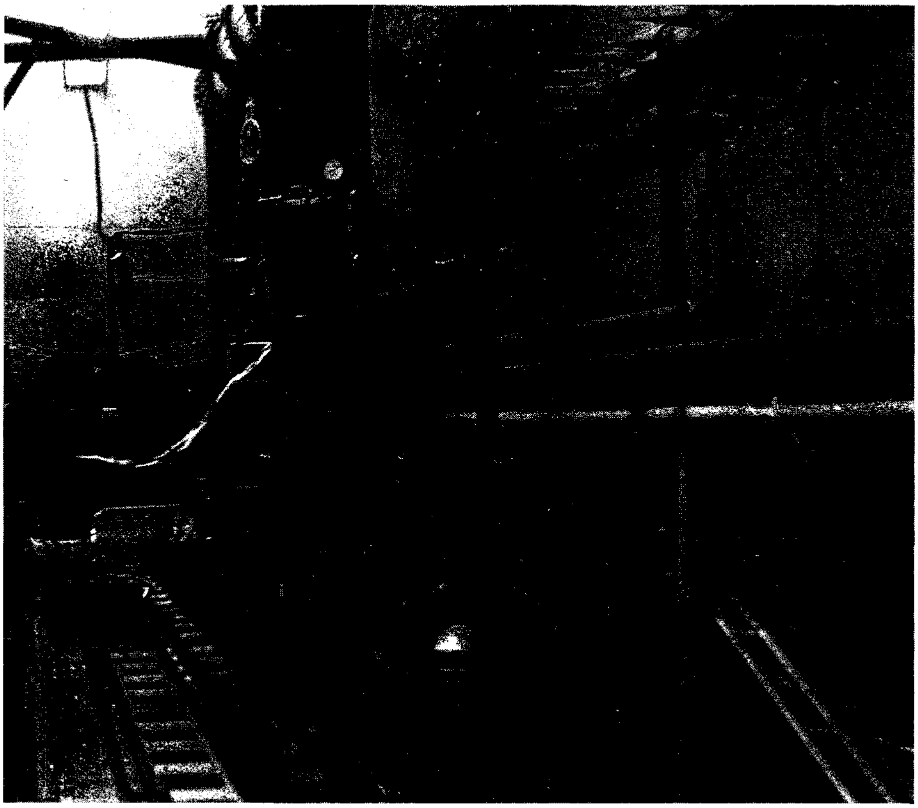
Christoph Leemann reported on the encouraging progress at the CEBAF recirculating electron linac, or rather two linacs joined at the ends by a stack of five separate beam channels which carry the beam at increasing energies as it returns for a subsequent pass through the linac. As well as good construction progress, CEBAF is also benefiting from its superconducting radiofrequency acceleration cavities (operating at 2 K) performing much better than expected, so that the machine should substantially exceed its 4 GeV design energy (see the CEBAF report which featured in our September issue, page 12).

After a chequered history, Brookhaven's RHIC superconducting ion collider, got the go-ahead in January of this year. Project manager Satoshi Ozaki explained the goal of accelerating a range of ions, from protons at 250 GeV to gold at up to100 GeV per nucleon. The expected luminosity with gold is 2×10^{26} with a lifetime of about 10 hours. To increase the luminosity it is planned to increase the number of bunches from 57 to114 and stochastic cooling is being envisaged to improve the beam lifetime.

The 3.8 km circumference RHIC tunnel, originally constructed more than ten years ago for the ill-fated Isabelle proton collider project, will house RHIC's twin rings of superconducting magnets crossing in six places. Originally funding was for six years but this has now been stretched to seven, although completion is expected to be delayed by only four months. The contract for the 360 superconducting dipole magnets has just been signed (September, page 23) and that for the 400 quadrupoles awaits the response of industry. Detector work is well under way for experiments at three of the six crossing points.

On the other side of the Atlantic, heavy-ion acceleration is popular too.

An initial section of the VLEPP electron-positron linear collider at the Institute for High Energy Physics, Protvino, near Moscow, which is being developed in collaboration with Novosibirsk specialists.



The PS at CERN accelerates sulphur and oxygen ions and is building a new linac for ions up to lead (April, page 8), while at GSI Darmstadt the Unilac accelerates all ions up uranium, which are then accelerated in the SIS ring to1 GeV nucleon. They then go to the ESR storage ring equipped with electron cooling. B. Franzke described experience with electron-cooled heavy ions in the ESR, where accumulation results in stacks of up to 7 mA of neon10+ ions. Experiments show that for very heavy ions radiative electron capture is the main mechanism for beam loss while for lighter ions it is transverse beam instabilities. Plans for the future described by Franzke include deceleration and a stochastic extraction system. Stochastic pre-cooling will also be implemented

Novosibirsk

A memorable presentation from Sasha Skrinsky of Novosibirsk appeared enigmatically on the programme as 'Novosibirsk Contribution', but put on record that Laboratory's many outstandingly original contributions to the field of accelerators. Skrinsky first took his audience back to the birth of colliding beam experiments when, in parallel with work at Princeton and Stanford, Novosibirsk had built the two160 MeV electron rings of VEP-1 operating at the then unrivalled luminosity of 3×10^{27}.

The advent of glasnost has not eliminated completely the mystery surrounding the Novosibirsk nomenclature of VEPP-2, VEPP-2M, VEPP-4 and VEPP- 4M, but Skrinsky came closer than most to clarifying the essential features of this brilliant dynasty of devices and the physics they generated. Now the Laboratory is nurturing plans to build a VEPP-5 complex using many of these earlier facilities to feed a phi-factory ('not a ring but a butterfly') and a B-factory.

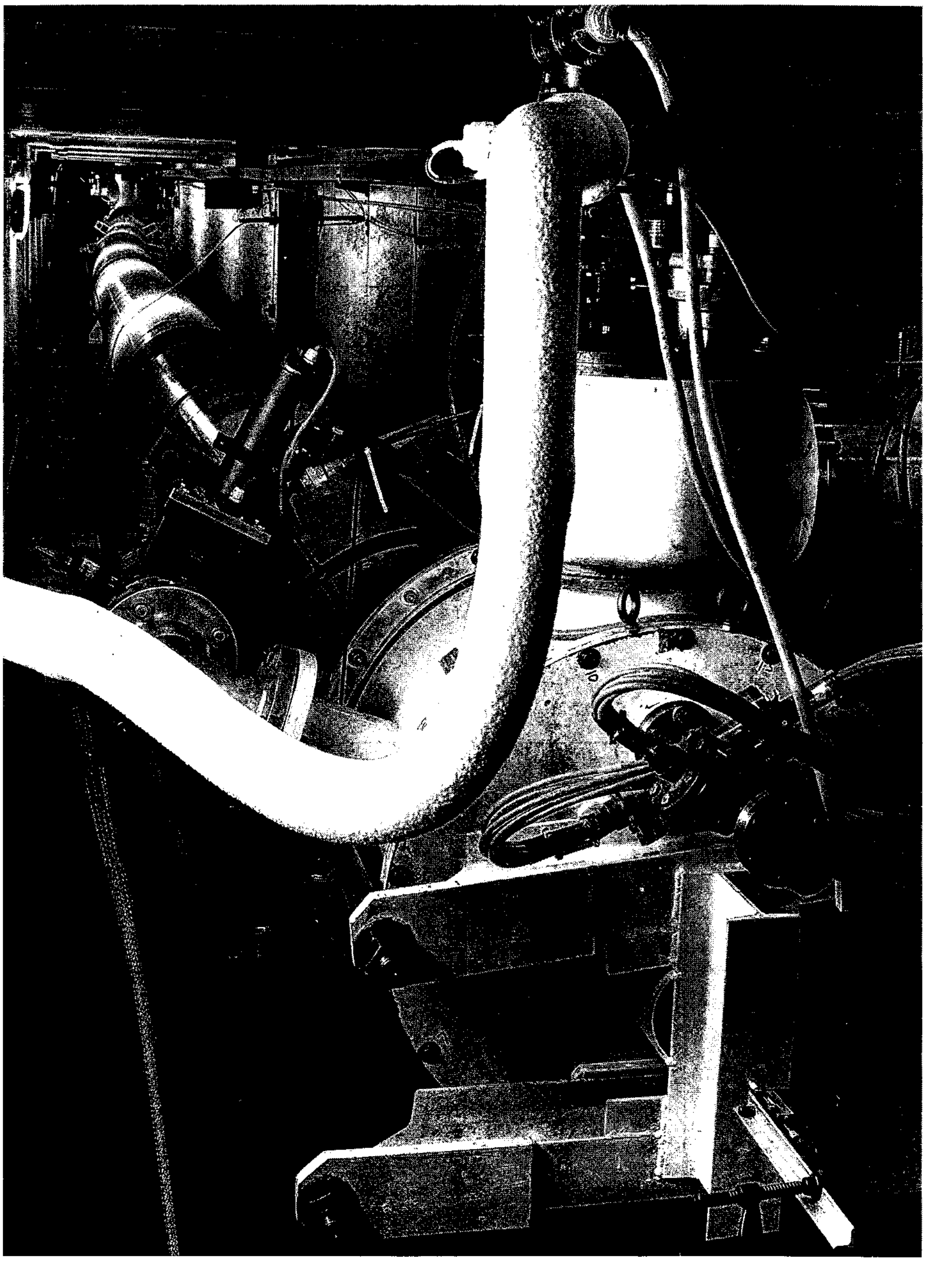
Now comes VLEPP, not at all as one would expect from its acronym like the earlier VEPPs or indeed CERN's LEP ring, but a linear collider being developed with IHEP Protvino (Serpukhov) and in collaboration with SLAC. The first 20 metres of structure are now being installed at IHEP.

But Skrinsky had not finished. I remember toasting the Novosibirsk Lab in 1976 with the sentiment that there was hardly an idea which we used in accelerator technology that had not originated in Siberia. Extravagant as that may have seemed at the time, at Hamburg came more evidence in the form of an impressive list of ideas that had originated with Gersh Budker, and later with Skrinsky and his talented collaborators, including novelties ranging from storage rings and electron cooling to fast kickers for the US Superconducting Supercollider. Finally, lost in admiration, we heard the final message that the Novosibirsk team was 'alive, active, remaining in reasonable condition but needing collaborators and financial support' – just like us. Skrinsky left the podium to prolonged and heartfelt applause.

Wideroë and the electron rings

To demonstrate that Western Europe too had contributed to accelerator concepts, the next session, which included authoritative reviews of the many proposals for new electron rings for factories and synchrotron sources, was chaired by the personality Gus Voss introduced as the 'Urvater', or originator, of the science

Superconducting magnets under test for the RHIC heavy ion collider at Brookhaven.



of particle accelerators – Rolf Wideroë.

With so many of us having been introduced to the idea of the linear accelerator with the help of an ancient and over-photocopied diagram of Wideroë's first linac of 1929, we were suddenly incredulous to be sitting in the presence of the master himself – at the triumphant age of 90.

We were reminded that Rolf Wideroë had invented not only the linac but the betatron, both at short notice within two years of Rutherford thundering his demand for 'a copious supply of atoms and electrons which have an individual energy far transcending that of alpha and beta particles from radioactive bodies'. Even the great US innovator Ernest Lawrence admitted his idea for the cyclotron was born after he had read Wideroë's pioneer paper.

A survey by S. Kamada covered the major world projects for particle factories. There are many, starting with the phi factories around a collision energy of 1.5 GeV and aiming for luminosities of the order of 10^{32}. These are followed in the energy scale by tau-charm factories, currently proposed by Spain, Caen (France), JINR Dubna, and ITEP Moscow with a collision energy just over 4 GeV and a luminosity of 10^{33}. They must measure resonance widths accurately, and a precision of less than 0.1 MeV is claimed by monochromatization. They also call for a high collision rate (25 MHz), micro-beta insertions and short bunches. They make use of wigglers, and usually only one interaction point is proposed because of beam-beam effects.

Higher still in energy come the B-factories proposed as PEP II (SLAC), CESR II (Cornell), Helena (DESY) and KEK B in Japan. These are the most demanding of the factories. The beams have asymmetric energies, typically 3.5 and 8 GeV and, like the tau-charm proposals, must have two separate rings, each with many bunches colliding in schemes with either horizontal or vertical crossing planes, some at a small angle and some with so-called crab-crossing.

There are also factories that plan to use protons, notably the KAON proposal at the Canadian TRIUMF Laboratory in Vancouver, described by Mike Craddock. The considerable complex of five proton rings is fully designed and could be funded in 1993 (September, page 18). Since the Tokyo HEACC in 1990, we have become used to Mike Craddock

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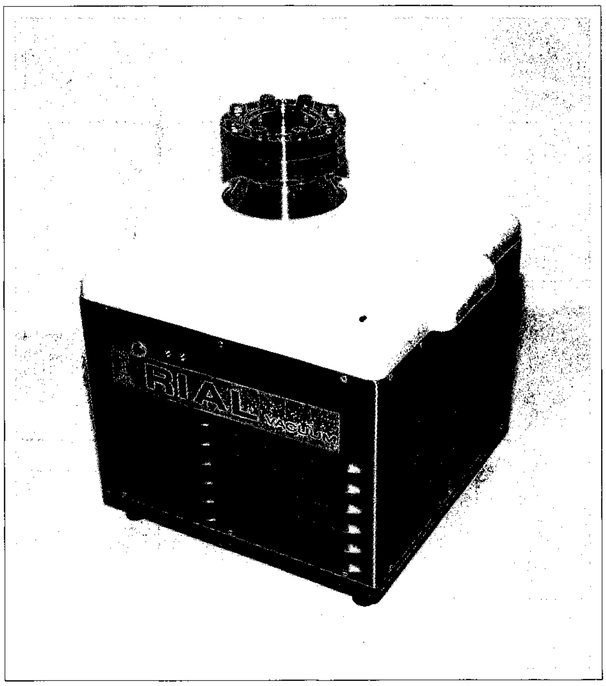

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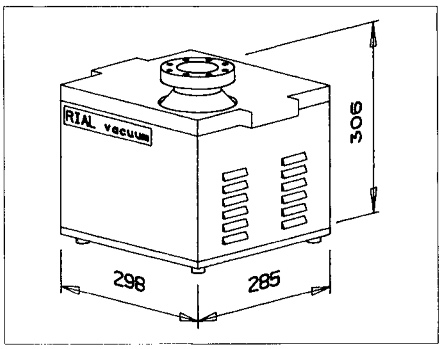

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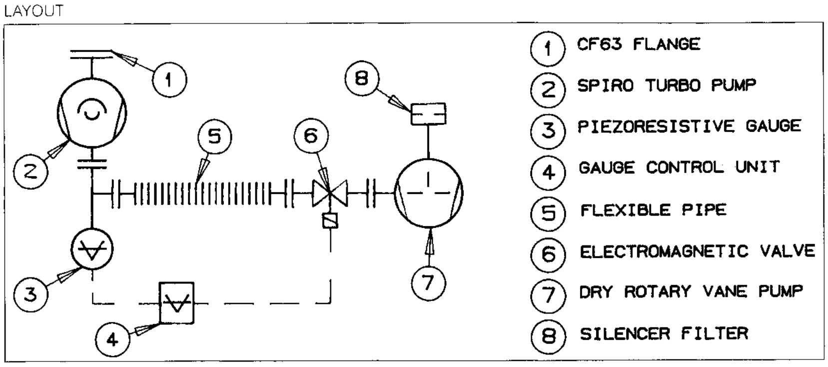

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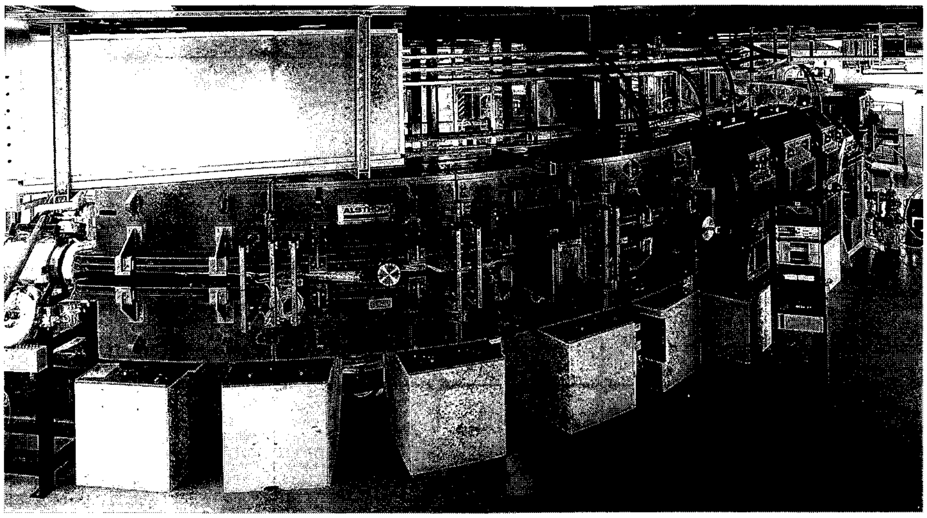

The wide aperture ESR storage ring at the Darmstadt heavy ion Laboratory uses electron cooling to stack beams.
(Photo Achim Zschau)

being on the point of being able to announce that the Vancouver KAON Factory has been approved. This time he was quick to take his cue from John Ellis and assure us that this was the 'last prediction of the KAON factory before it actually happened'.

Governments may have changed in both Ottawa and British Columbia but there is little in the KAON factory design that was not already well thought out in 1990. The team has not been idle, however, and a number of hardware tests involving magnets, power supplies and novel fast repetition rate kickers have been successfully concluded. The only topological change, thanks to a joint TRIUMF – INR Moscow study, is a racetrack booster design to replace the old circular design. Radiofrequency cavities can now be placed in dispersion-free straights where there is no danger of exciting synchrobetatron resonances.

On a completely different accelerator front, Herman Winik covered synchrotron radiation sources, first their applications, ranging from X-ray microscopy to environmental studies, and then the successive development of five generations of synchrotron radiation sources.

After the 'zero' generation of electron synchrotrons came the first generation, included storage rings like SPEAR and DORIS intended for high energy physics. The second generation includes purpose-built storage rings such as LURE at Orsay, and the third generation, including the European Synchrotron Radiation Facility (ESRF, Grenoble) are characterized as emittance rings optimized for insertion devices (wigglers and undulators). Proposals are being tabled for fourth generation sources with even lower emittance. The radiation from free electron lasers is also approaching diffraction limits.

Synchrotron radiation is one of the big spinoff successes of accelerator physics. Worldwide there are altogether 41 synchrotron radiation laboratories with 59 storage rings of which 30 are operational, 16 being constructed and 13 under design or proposed. As well as the many accelerator specialists working at these Laboratories, this field attracts users from almost all branches of science, where high brilliance radiation is needed for detailed structure studies and applications.

The final day of the Hamburg conference was reserved for the leviathans; UNK, LHC and SSC, reported last month, and a mixture of impressive recent success stories – LEP at CERN, TRISTAN in Japan, CESR at Cornell, and a spirited description of China's first and very successful electron ring, BEPS. This was given by Chuang Zhang to whom the Courier awards a prize for the most entertaining presentation at Hamburg.

Steve Myers of CERN quoted the 'all out best luminosity' at CERN's LEP electron-positron ring as 11×10^{30}, just below the design value of 13×10^{30}. They had found the single beam current to be limited by transverse mode coupling instability at injection but the injected two-beam current was limited by residual beam-beam effect. Moving from 60 degrees to 90 degrees per period in the lattice had raised the beam-beam limit to 0.04 for a beam squeeze achieving a beta star of 8 cm.

The planned upgrade to 90 GeV per beam – or thereabouts – was pushing ahead and required 192 superconducting cavities working at 5 MV/m. Already there had been tests with eight of these cavities in the ring and all the other components in the scheme were on time so far. Other improvements in the pipeline included colliding eight bunches with the help of the pretzel separators (October, page 17), and polarization. Myers' conclusion was 'Big is beautiful – but difficult!'

Hamburg Conference hosts DESY, and Gus Voss in particular, are to be congratulated on their unobtrusive yet efficient organization. This was no mad scramble from one parallel session to another; instead, an orderly succession of presentations,

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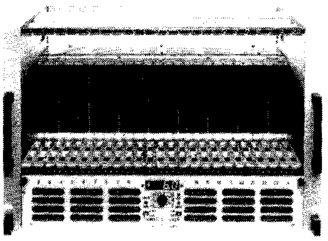

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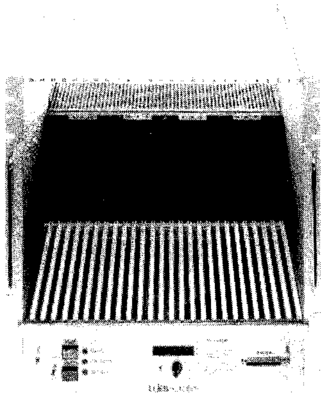

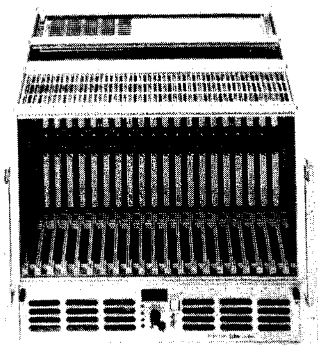

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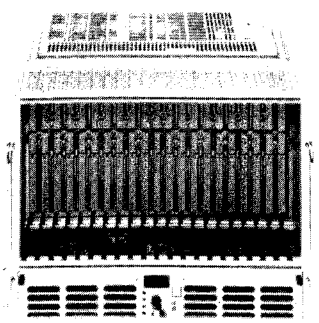

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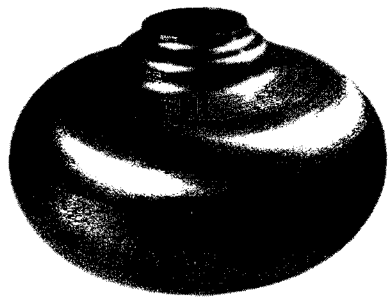

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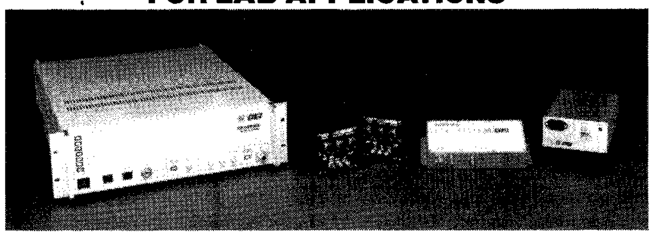

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each either a review of a field by an expert, or a major contribution to that field by an actual contributor. All other information was to be found in poster sessions. (It worked well except once when the posters went up a day before the appropriate review talk and people got lost in a forest of information.) A comprehensive trade exhibition underlined the industrial importance of accelerators.

By Edmund J.N.Wilson
Leader of The CERN Accelerator School

CERN
LHC Experiments Committee

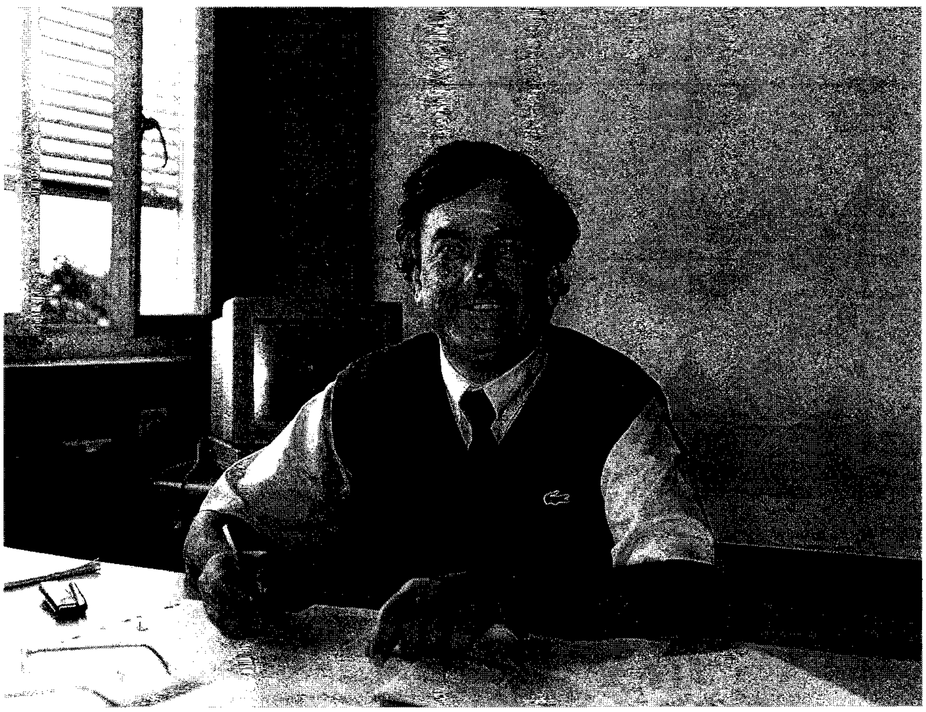
With preparations now well underway to ensure a well defined and fully costed experimental programme by the end of 1993, the groundwork for the LHC proton collider to be built in CERN's 27-kilometre LEP tunnel enters a new phase.

After a successful meeting in March 1992 in Evian-les-Bains, where experimental groups presented 'Expressions of Interest' (May, page 1), Letters of Intent for the major detectors to study proton-proton scattering were submitted on 1 October (September, page 16).

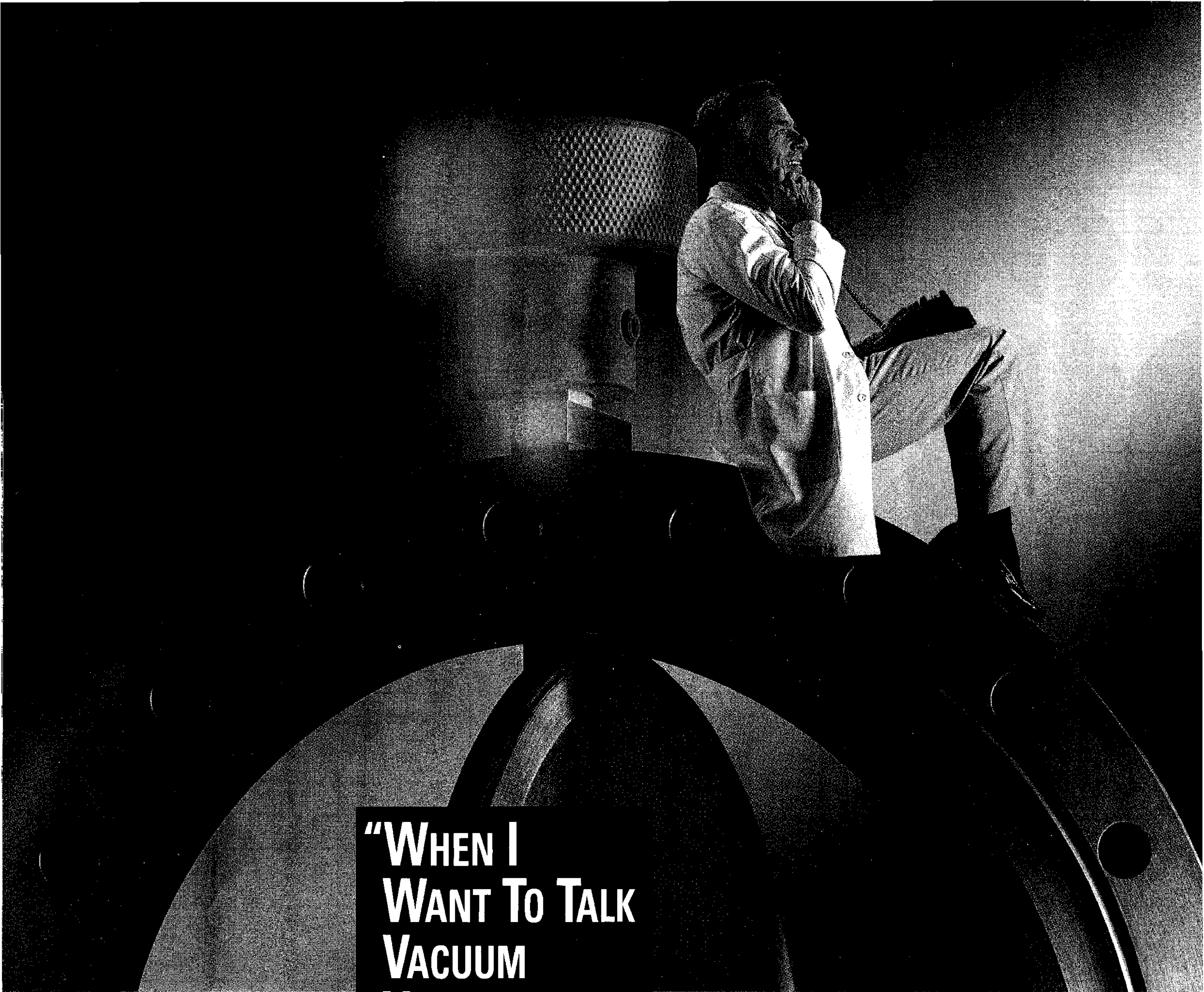
Meanwhile the Laboratory has set up an LHC experiments committee (LHCC), chaired by Jean-Jacques Aubert, Director of the Centre de Physique de Particules, Marseille. The LHCC's first task will be to evaluate these Letters of Intent en route to final detector designs. The complexity of these detectors, the demanding experimental environment, and practical constraints like manpower and financial resources will require intensive interaction between the Committee and the collaborations, leading to a gradual convergence towards approved detector designs.

An optimal LHC experimental programme would have two major set-ups to study proton-proton collisions up to the highest available luminosity. Initially four ideas were tabled – ASCOT, EAGLE, CMS and L3P. Subsequently the first two joined forces as ATLAS.

An important constraint is the financial envelope in which the experiments have to operate. A guideline for the two selected proton-proton detectors is provided by the



Jean-Jacques Aubert of Marseille is Chairman of the new LHC Experiments Committee at CERN.



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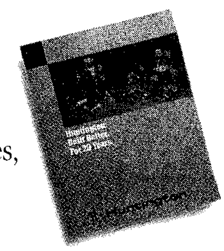

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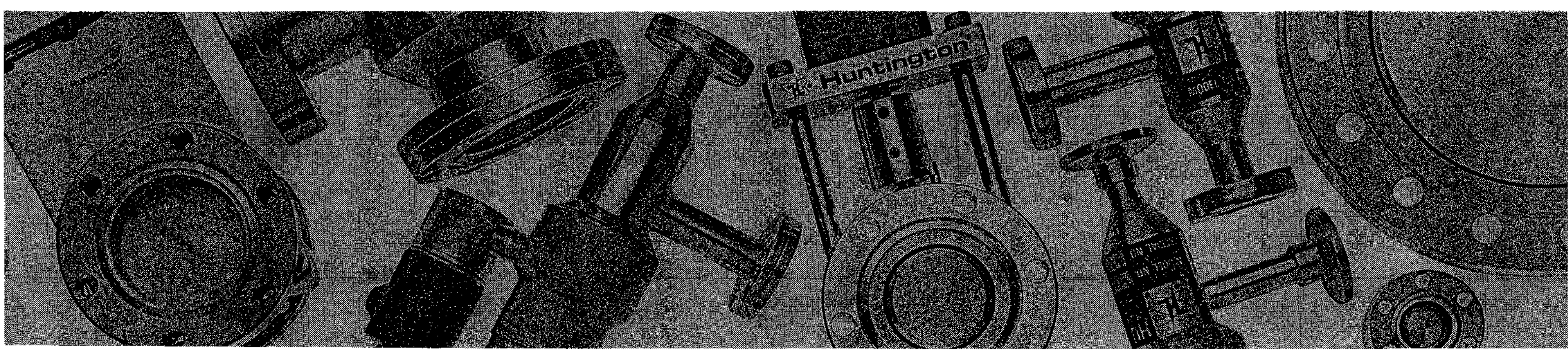

integrated costs of the four detectors already operating at the LEP electron-positron collider. This suggests that each of the two big LHC detectors should aim for a price tag of about 300 million Swiss francs for a core detector, ready to do physics after about six years of construction. The possible completion of these detectors should be foreseen in the years following the LHC commissioning, taking into consideration the experience of the first running periods and the evolving physics requirements. In any case the strategy followed by CERN should avoid wasteful descoping iterations and keep experimental choices open as long as possible.

The LHCC will be advised by experts on a variety of technical issues, and close cooperation between the LHCC and the existing Detector Research and Development Committee (DRDC) is foreseen. A small group of experts is being set up to give advice on the detector magnets. In the longer term, the LHCC will function in a similar way to traditional experiment committees. It will receive proposals for experiments, nominate experts to evaluate them, organize public presentations, and present recommendations to the Research Board.

The first (closed) LHCC meeting on 2 October discussed the way the committee will function, defined a refereeing structure and assigned responsibilities. It also heard reports from the DRDC and on the status of the LHC machine preparations. The second meeting on 5-6 November features open presentations of the Letters of Intent, followed by a first discussion in closed session.

The LHCC members are:

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G. Brianti (CERN)
R.J. Cashmore (Oxford)
L. DiLella (CERN)
P.J. Dornan (Imperial, London)
P. Duinker (NIKHEF-H)
K. Einsweiler (Berkeley)
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G. London (Saclay)
L. Maiani (Rome)
G. Mikenberg (Weizmann)
K. Potter (CERN)
K. Pretzl (Bern)
C. Rubbia (CERN)
K. Schubert (Karlsruhe)
D.M. Sendall (CERN, Secretary)
D.O. Williams (CERN)
S. Yamada (Tokyo).

The first Open Session of the LHC Experiments Committee takes place on Thursday 5 November in the CERN Main Auditorium.

HEIDELBERG
Polarized target tested

The polarized hydrogen target for storage rings developed by the FILTEX Heidelberg/Marburg/Munich/Madison collaboration has been successfully tested in Heidelberg's TSR low-energy cooler ring.

The target is based on W. Haeberli's idea of a storage cell fed by an intense atomic beam source. This technique has been applied in the VEPP-3 storage ring at Novosibirsk. Experiments with such targets have been proposed for LEAR (FILTEX), the Indiana Cooler Ring, the stretcher rings at NIKHEF and Bates, and for the HERA electron ring at DESY (HERMES). A scheme using a single beam passage without a storage cell is being investigated at CERN for the LEP ring.

Recent improvements on the polarized hydrogen source have resulted in a flux of 8×10^{16} atoms per second (with 2 possible substates due to hyperfine splitting). This is injected into the thin-walled T-shaped storage cell (11 mm in diameter and 250 mm long) in the low-beta TSR section where the beam is squeezed.

The cell walls are Teflon coated to inhibit recombination and depolarization of the hydrogen atoms. A weak guide field (5 gauss) orients the atomic spins. With three differential pumping stages on each side, the pressure outside the target section is kept in the 10^{-10} mbar range.

After some initial trials, the TSR crew was able to stack beams up to high intensities with the narrow target tube in place. Stored alpha beams of 27 MeV have been used to determine target density and polarization. For this, recoil protons are detected by counters either side of the beam axis. The recoil proton spectra turned out to be surprisingly clean, practically without background. The stored beam lifetime with the target cell in place was one hour without gas and about 11 minutes with polarized gas. The target polarization is measured from the count rate asymmetries.

During the tests, the target cell was cooled down to 60 K to increase target density. At the optimum working temperature of 80 K and with two substates of hydrogen, the density was 10^{14} atoms per sq cm with a polarization of 45%. With two hyperfine substates in a weak guide field the maximum polarization is 50%. At least 90% of the initial

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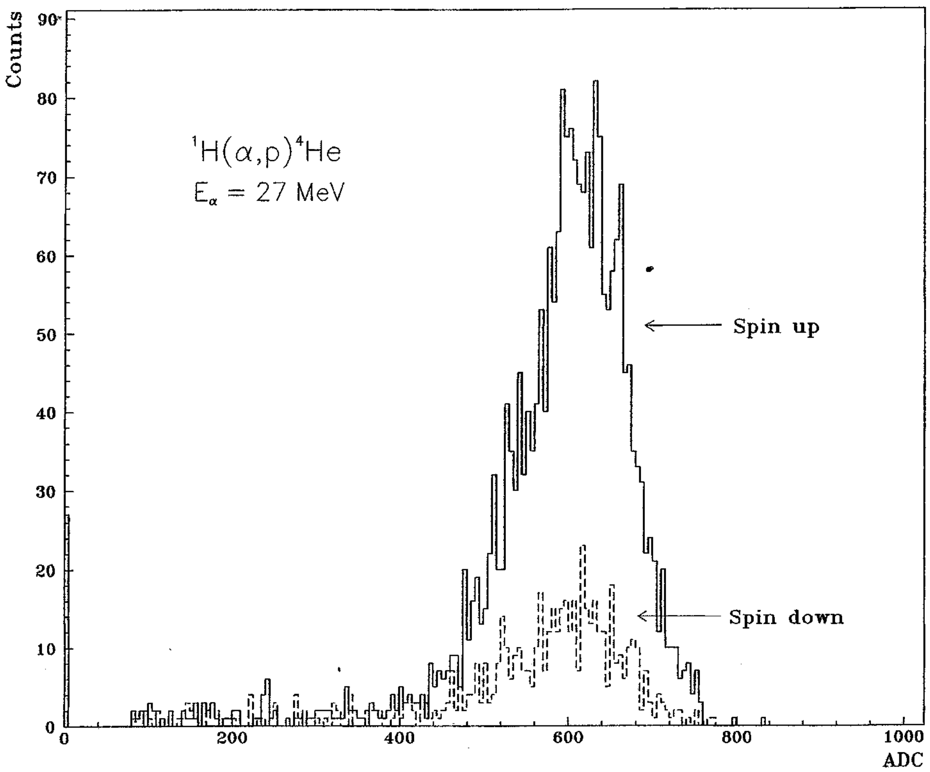
The polarized hydrogen target for storage rings developed by the FILTEX Heidelberg/ Marburg/Munich/Madison collaboration has been successfully tested in Heidelberg's TSR low-energy cooler ring. Stored 27 MeV alpha beams were used to determine target density and polarization with recoil protons detected by counters either side of the beam axis. the measurement took about 10 minutes.



hydrogen polarization is conserved, although the atoms undergo about 500 wall collisions before leaving the cell. This demonstrates the high quality of the cell coating developed by the Wisconsin group. Another important result was that after several days of running with alpha beams between 50 and 300 microamps no deterioration of the target polarization was observed.

Due to the very short run time of about 10 minutes, the dependence of target parameters on cell temperature and long-term stability could be studied for the first time with high precision. The results show that a polarized storage cell in a storage ring is reliable and highly efficient. For a FILTEX-type target in a proton ring (with just one hyperfine level in a weak guide field) densities of about 5×10^{13} atoms per sq cm with polarization in excess of 80% can be produced.

For a HERMES-type target in an electron ring (two hyperfine substates in a strong guide field) densities of more than 10^{14} per sq cm with 80 or 90% polarization can be expected.

From Erhard Steffens

LOS ALAMOS Hadron future

At a Workshop on the Future of Hadron Facilities, held on 15-16 August at Los Alamos National Laboratory, several speakers pointed out that the US physics community carrying out fixed target experiments with hadron beam had not been as successful with funding as it deserved. To rectify this, they said, the community should be better organized and present a more united front.

The two-day informal workshop was organized by the Los Alamos Meson Physics Facility (LAMPF) Users Group immediately preceding its annual Users Meeting. The workshop focused on how the fixed target, hadron beam community might implement its physics goals in the context of a rapidly changing and uncertain budget situation at the US Department of Energy (July, page 18).

Speakers from Laboratories in the US, Canada, Japan and Europe described the range of activities under way and possible plans for the future. As well as examining the situation community-wide, the workshop looked specifically at the dialogue on future plans at LAMPF, to broaden the scope and perspective in which this dialogue takes place, and to begin building a broader community of researchers interested in fixed-target hadron-beam physics.

Although the hadron energy range extends from 1.5 to 150 GeV, the physics of these machines focuses on two main areas. The first is understanding quark interactions in the region where quarks are confined inside nucleons. This would range from studying subtle ('higher twist') corrections to perturbative quark field theory calculations at the upper end of the energy scale, to examining hadron spectroscopy, including the possible modifications arising when the hadrons are created in the nuclear medium.

As well as complementing what can be done at electron machines, this work also provides measurements and models that eventually will be required to understand new heavy ion collider data. Another focus is high precision tests of the Standard

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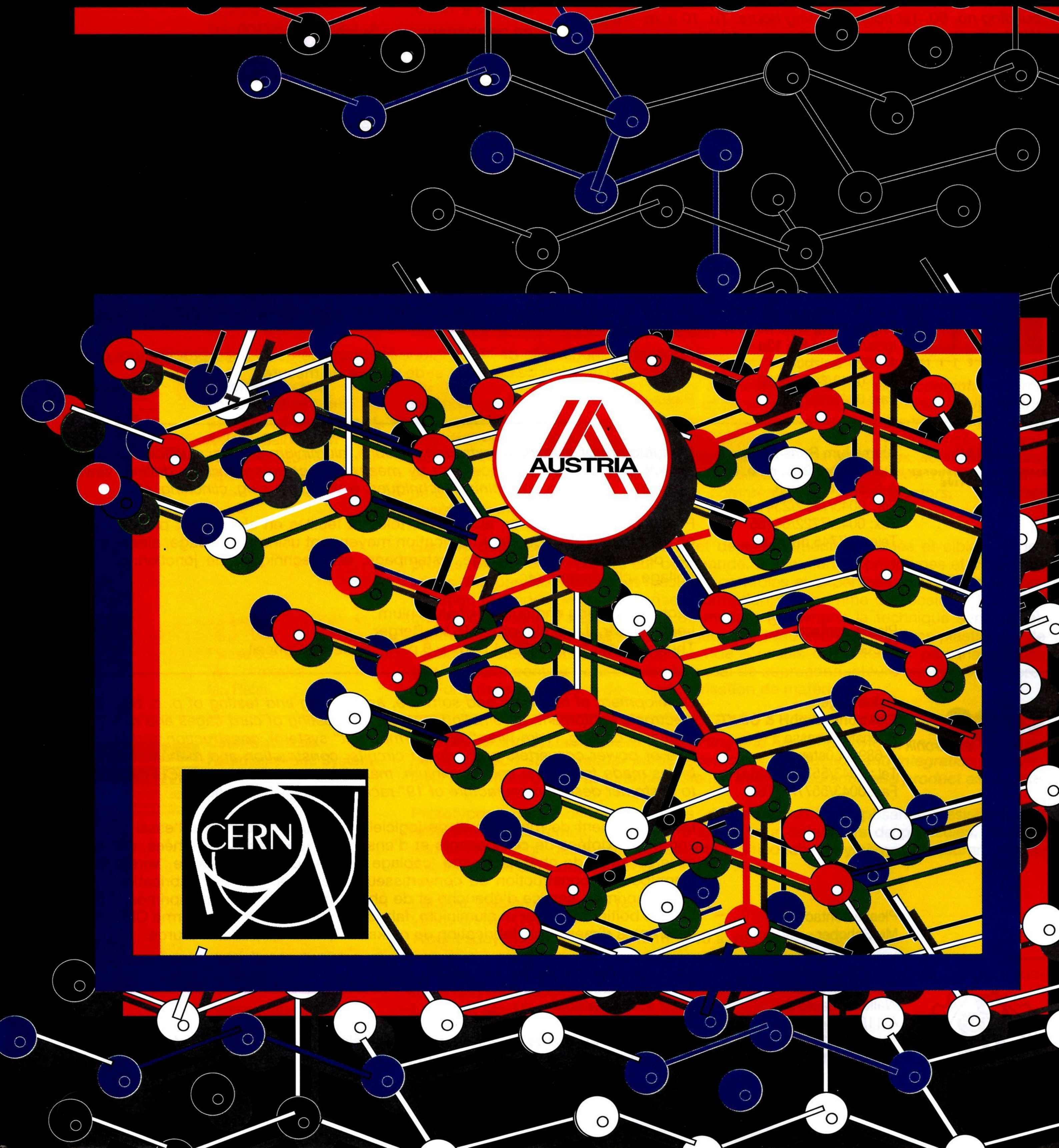

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Lecture: Space technologies for LHC machine and experiments (light weight structures and multi layer insulation)
Lecturer: Mr. Miroslav Hager
Wednesday, 19. Nov. 1992: 11 a. m. – 12 a. m., Salle du Conseil

Please contact:
Mr. Ebner

PCD Polymere
Gesellschaft m.b.H.

PCD Polymere GmbH
St.-Peter-Strasse 25
A-4020 Linz
Tel.: 0043/732/5981
Fax: 0043/732/5981-5242

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A-6840 Götzis
Tel.: 0043/5523/2369
Fax: 0043/5523/2369-7

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Please contact:
Mr. Salzgeber
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Please contact: Mr. Withalm, Mr. Berset

Steyr-Daimler-Puch
Fahrzeugtechnik
Ges. m. b. H.
Space Technology
Puchstrasse 85
A-8020 Graz
Tel.: 0043/316/293631
Fax: 0043/316/293631-17

Design and manufacture of equipment and systems made of stainless steel, titanium and light alloys (for feed lines LOX LH2), risk analysis, CAD-piping, FE-analysis, cryogenic systems

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GmbH
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A-5020 Salzburg
Tel.: 0043/662/88950
Fax: 0043/662/88650-65

Please contact: Mr. Nindl

Consulting and engineering service

Service de conception et de consultation

Lecture: Determination of material parameters for safety calculations of underground structures
Lecturer: Mr. Gerald Zenz
Wednesday, 19. Nov. 1992: 2 p. m. – 3 p. m., Salle du Conseil

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Test-Fuchs
Ing. Fritz Fuchs
Ges. m. b. H.
Raabser Strasse 45
A-3812 Gross Siegharts
Tel.: 0043/2847/2293-0
Fax: 0043/2847/2560
Telex: 72246 testfu a

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Please contact: Mr. Fuchs

Voest Alpine Machinery
Construction &
Engineering
Ges. m. b. H.
Lunzer Strasse 78
A-4031 Linz
Tel.: 0043/732/5987-0
Fax: 0043/732/5980-8822

Agent/Représentant:
Voest Alpine AG
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Model. Studying rare decays at ultra high precision can probe an energy scale well beyond what is achievable even at the new generation of superconducting proton colliders.

The meeting showed that there is a broad based community interested in this physics which should moreover present a more coherent front to the funding agencies. For their part, LAMPF users will continue to discuss future plans for the Laboratory to provide a better focus in the broad context emphasized at the Workshop.

From David J. Ernst
Chair, LAMPF Users Group

Physics monitor

We still love SUSY

Supersymmetry, affectionately known as SUSY, is still the darling of theoretical particle physics. Invented some 20 years ago, the charismatic idea really took off at the beginning of the 1980s. At the time, a workshop at CERN reflected the youthful enthusiasm for these new ideas.

Despite experimenters hunting high and low, and with theorists never wavering in their devotion, SUSY has remained aloof. However mature SUSY suitors are reluctant to abandon their fascination. The continuing love affair was underlined in a latest CERN workshop – 'Ten years of SUSY confronting experiment' – organized by John Ellis, Dimitri Nanopoulos and Aurore Savoy-Navarro.

Opening the meeting, CERN Theory Division Leader John Ellis reminded the audience of the basic motivations behind SUSY.

The current Standard Model of physics uses the electroweak picture, unifying electromagnetism with the weak force, in tandem with the field theory of quarks and gluons (quantum chromodynamics – QCD).

The next logical step is to unify QCD and the electroweak picture, in the same way that the latter unifies electromagnetism and the weak force. On paper this can be achieved, but the typical mass scale of the resultant Grand Unified Theory (GUT, where all the forces blend into one) is of the order 10^{15} GeV, in stark contrast to the 100 GeV or so of the electroweak picture. This awesome chasm between one unification and the next – the 'Hierarchy Problem' – is difficult to swallow.

Constructing Grand Unified Theories brings other problems. The Universe is expanding only very slowly, with its initial explosive Big Bang now stretched out into a gentle heave, requiring only a small 'cosmological constant' to counter the pull of gravity. On their own, GUT field theories give an absurdly high value for this parameter. As well as making a more comfortable cosmological constant, SUSY also provides a natural scenario for particles with the relatively small masses we are used to.

What is supersymmetry? Normally, particles come in two kinds – the quarks and leptons which are the source of the basic fields; and the photons, Ws, Zs, and gluons which carry the forces between these source particles. Quarks and leptons are 'fermions', obeying the quantum restrictions of the Pauli Exclusion Principle. The field particles on the other hand are 'bosons' with no such quantum accommodation restrictions.

SUSY gives each fermion field particle a boson 'spartner', and vice versa, doubling the total number of particles on the menu. Quarks pair with 'squarks', leptons with 'sleptons', photons with 'photinos', etc.

As well as having amusing names, these additional particles provide an immediate potential source of 'dark matter' – the as yet invisible material which nevertheless has to provide the bulk of the mass of the Universe. Of all the SUSY particles, the most interesting is the lightest (probably the photino). The SUSY particles

Aurore Savoy-Navarro was one of the organizers of the recent 'Ten years of SUSY confronting experiment' workshop at CERN. Introducing the event she called for supersymmetry (SUSY) 'to be brought out of the ghetto'.

form a chain, with heavier ones decaying into lighter ones. Eventually SUSY matter falls to the level of the lightest particle, and there becomes stable. This sets a stage for dark matter.

The special relations between SUSY's fermion and boson partners also lead to the neat cancellation of otherwise troublesome mathematical divergences. Whenever this happens, theorists are always convinced they are on to something.

Appealing though this scheme is, no explicit trace of any sparticle has been found in the past decade. Undeterred, the CERN workshop duly surveyed the graveyard of all the various searches, and displayed the limits beyond which ongoing or new experiments have to probe.

However in 1991 SUSY hopes soared with the appearance of new precision information from experiments at CERN's LEP electron-positron collider. This gave more confident extrapolations from present energy levels towards an eventual GUT limit. These suggested that unaided, the forces would not converge in one place. Some new behaviour looked like setting in around 1000 GeV to take over from the low energy extrapolations and steer them correctly towards a common convergence.

This has catalysed a new round of highly motivated analyses giving possible bounds and limits on SUSY parameters. Additional information on SUSY bounds comes from the sophisticated schemes incorporating radiative corrections to provide Standard Model and other limits.

However several speakers at the workshop stressed that immediate progress is difficult pending discovery of the sixth ('top') quark. Once this particle is found and its mass accurately measured, a blindfold will have been removed.

Another difficulty is the mystery surrounding the Higgs sector, the mechanism (whatever it is) responsible for the spontaneous symmetry breaking at the heart of the electroweak picture. Here again, ongoing experiments are successively pushing back the limits, but with theorists unsure about the exact form of the mechanism, these uncertainties are easier to live with.

As well as charting the limits contributed by past and current experiments, the CERN workshop assessed in detail the SUSY potential of experiments still in the pipeline. These will make their contribution later this decade, or even in the next. The big collaborations preparing for these studies have already done a lot of SUSY groundwork.

In the search for the lightest SUSY particle, accelerator experiments are complemented by studies at large underground detectors constantly searching for the chance arrival of projectiles from the cosmos ('SUSY from the sky'). Searches would benefit from new experimental techniques, like low temperature calorimetry, now being perfected.

Perhaps the most intriguing hint of all comes from the new results from the COBE satellite on the tiny fluctuations in the microwave background radiation. These slight ripples mirror the initial quantum seeds of the Big Bang itself. At the CERN workshop, summarizer Ugo Amaldi pointed out an intriguing coincidence. The GUT limit, where all forces have equal strength, looks to be very close to the scale parameter characterizing the super-rapid inflation which transformed a random quantum fluctuation into an infant Universe.

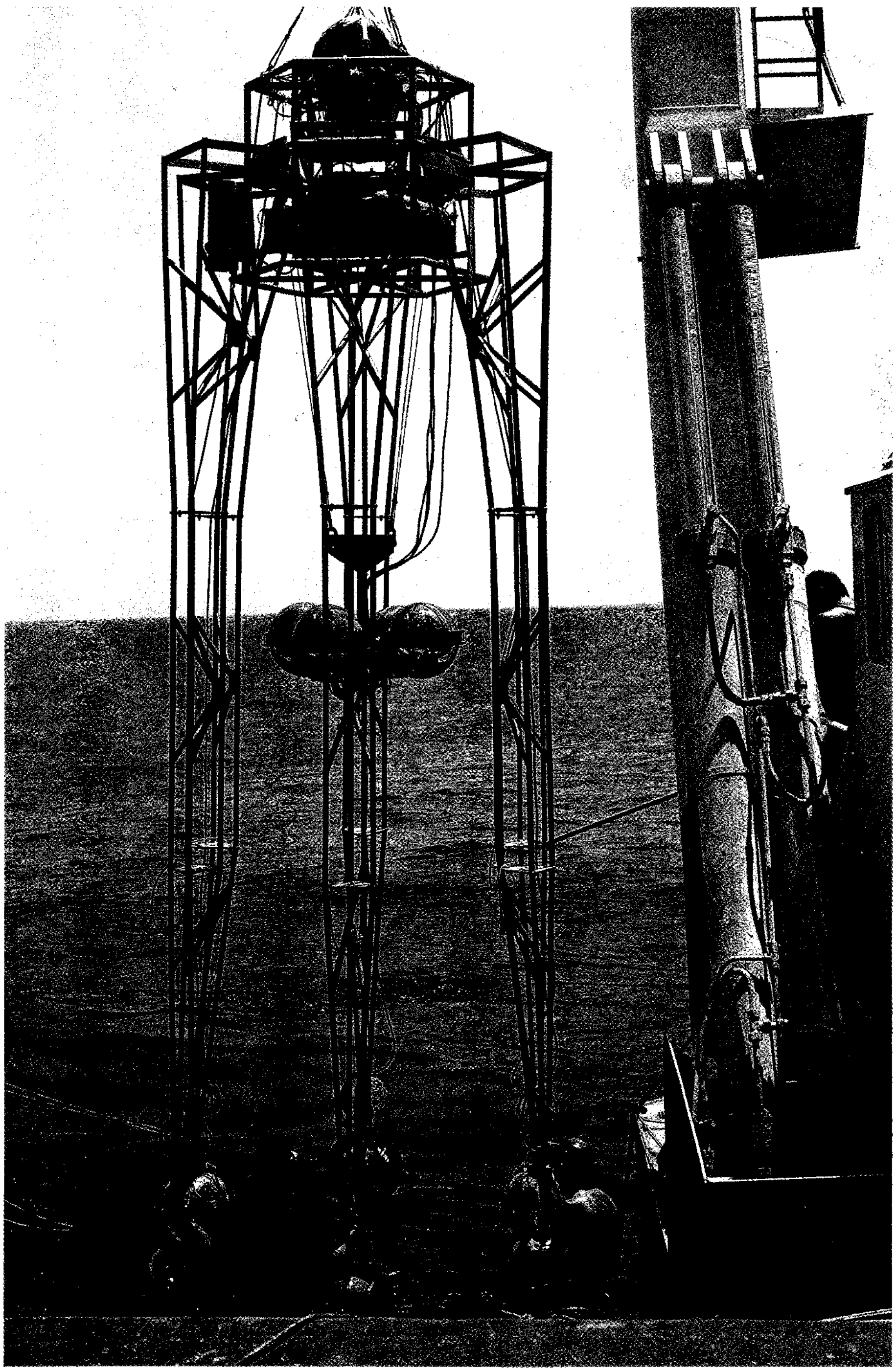
Are we receiving a message?

MEDITERRANEAN Underwater neutrinos get off the ground

Now funded is the initial stage of NESTOR, an imaginative new programme for a dedicated underwater neutrino astroparticle physics laboratory. Located in the international waters off the southernmost corner of continental Europe near the town of Pylos in S.W. Greece, NESTOR (NEutrinos from Supernovae and TeV sources Ocean Range) recalls the wise king of Pylos who counselled the Greeks during the Trojan war, an excellent tradition for new scientific goals of detecting neutrinos.

The main initial objective is to build a deep water, high energy neutrino

In the search for a good area for underwater neutrino detection, in July 1991 a collaboration of physicists from the University of Athens and the Institutes for Nuclear Research and for Oceanology of the Russian Academy of Sciences surveyed the waters off the coast of Pylos, Greece. A titanium hexagonal structure of 7 m radius using 10 phototubes with 15 inch photocathodes was deployed down to a depth of 4100 m.



telescope of at least 100,000 square metres for secondary muon detection. While a full million square metres is doubtless the goal for a second generation detector, the general consensus is that 100,000 square metres to detect point and diffuse sources of neutrinos is a sensible starting point and the next logical step after the 20,000 square metres of the DUMAND II scheme off Hawaii.

The best candidates for point sources of neutrinos seem to be in our Galaxy – the well studied X-ray binary objects which are so luminous in the electromagnetic spectrum and suggest the existence of high energy particle acceleration mechanisms. If the episodic point sources of TeV and PeV gamma rays claimed in the last decade turn out to be true, then a 100,000 square metre detector should detect some of them.

It is curious that the prediction of gamma ray fluxes from such objects is much more difficult than the prediction of neutrinos: the conditions to produce neutrinos are much more robust because neutrinos, once created, are difficult to remove, while high energy gamma rays are easily attenuated by matter and other photons.

Several varieties of diffuse sources of neutrinos are predicted. One sure bet is the interaction of cosmic rays with the gas and dust in our Galaxy. More exciting is neutrino production in collisions of ultrarelativistic protons with the intense photon field in Active Galactic Nuclei.

A favourable site for a neutrino detector allowing a wide range of studies has been located near Pylos, in the southwest corner of the Peloponnese. Shallow water neutrino or gamma-ray physics (along the lines of several proposals, e.g. GRANDE, LENA, NET), would be possible in the protected waters offshore of Pylos, in the rather large bay of Navarino, which is almost like a 50-m deep lake. In addition, deep water neutrino physics studies (à la DUMAND) could be mounted in the deepest trench of the Mediterranean nearby where depths exceed

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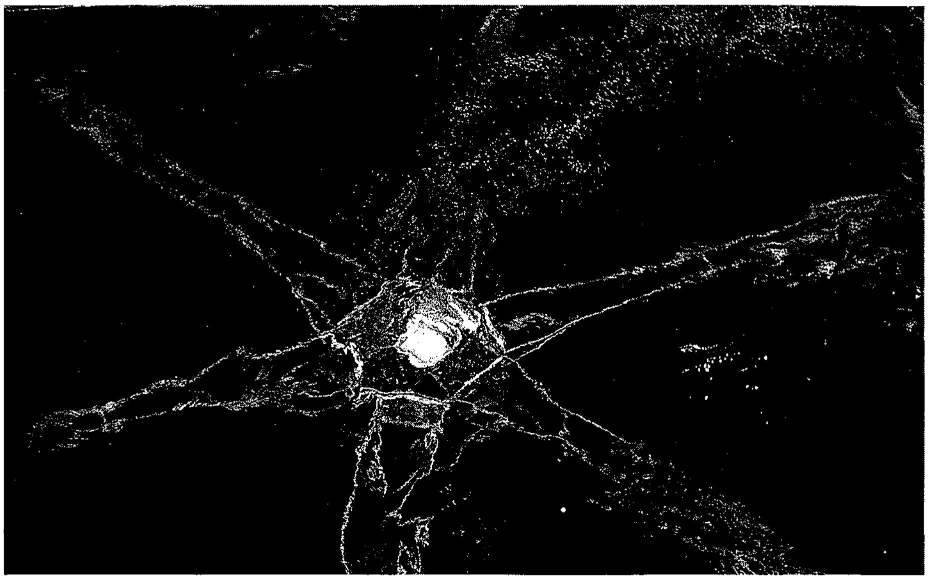
For the Russian/Greek underwater neutrino detection study, six of the phototubes were located at the corners of the hexagon and four 3.5 meters below the centre, giving the deployed detector the appearance of a large octopus ('hexapus'). The vertical intensity and angular distribution of downgoing muons were successfully measured.



5000 m.

These ideal waters are even closer to shore than in Hawaii, and with comparable oceanographic characteristics. With NESTOR and DUMAND almost opposite each other on the surface of the planet, the two detectors together would always have the full sky in view, and thus monitor the whole cosmos.

In July 1991 a collaboration of physicists from the University of Athens and the Institutes for Nuclear Research and for Oceanology of the Russian Academy of Sciences surveyed the waters off the coast of Pylos using the Research Vessel Vityaz. A titanium hexagonal structure of 7 m radius using 10 phototubes with 15 inch photocathodes was deployed down to a depth of 4100 m. Six of the phototubes were located at the corners of the hexagon and four 3.5 meters below the centre, giving the deployed detector the appearance of a large octopus, or more accurately a hexapus. The vertical intensity and angular distribution of downgoing muons were successfully measured.

The environmental conditions at the proposed site were studied and the sea bed mapped in detail. With minimal underwater currents and good light transmission characteristics, the results were encouraging. At a depth of 3800 m there is a flat valley in the shape of a triangle with sides of 4 to 5 miles long, and only 7.5 miles from the shore, adjacent to the Sapienza lighthouse which will be used as the counting house in the experiment.

With funding in place, the collaboration is now going ahead with a full design proposal. They aim at an expandable modular configuration using conservative, proven technology for a deep water (3800 m) high energy neutrino detector, but which will yield unique physics capabilities and go significantly beyond what is possible with the DUMAND II detector.

The basic detector is housed in a titanium cylinder with glass endcaps,17 inch hemispheres with a glass thickness 15 mm, tested to the depth equivalent of 6000 metres, and a cylindrical central titanium section housing two 15 inch photomultipliers.

The detector, called ODM (Omni-Directional Module), has isotropic optical response. Six ODMs will be placed at the corners of a horizontal hexagon, and a seventh at its centre. The radius of the hexagon is planned as 15 m, the titanium piping arms being attached directly to the ODM cylinders. This design is a straightforward extension of the module used in last year's test.

Hexagons could be stacked into 'towers', with the vertical distance between hexagonal floors near 40 m, matching well the measured light transmisssion length. With 40m inter-hexagonal floor spacing and 7 phototubes from a lower hexagon looking up and the same number from the upper hexagon looking down, the whole intermediate volume will be monitored. A total of 12 such hexagonal floors are planned for one tower.

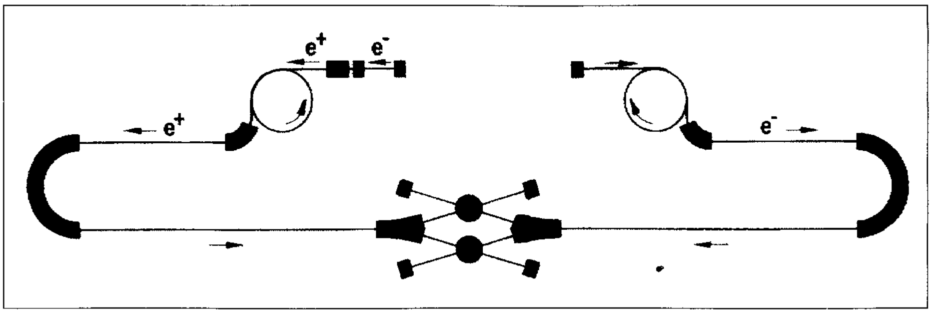
Although the hexagons will have a mechanical radius of 15 m, they will be sensitive to high energy muons out to 30 m. With a sensitive area of about 3000 square metres for neutrinos in the vertical direction and 30,000 square metres in the horizontal, such a tower is optimized for horizontally arriving high energy particles, such as those from active galactic nuclei (ultra high energy neutrinos are attenuated while traversing the earth). The geometry has not yet been optimized, but preliminary indications are that the need for a full 100,000 square metre array can be satisfied with a hexagonal configuration of seven towers with a spacing of 100 m.

With a large neutrino detector, long baseline neutrino oscillation experiments could also be envisaged, using beams of synthetic neutrinos

from a major Laboratory such as CERN.

The NESTOR collaboration hosted an informal workshop in Pylos for deep water neutrino detection in October.

A possible scheme for incorporating two beam intersections in an electron-positron linear collider.



LINEAR COLLIDERS 1992 workshop

As work on designs for future electron-positron linear colliders pushes ahead at major Laboratories throughout the world in a major international collaboration framework, the LC92 workshop held in Garmisch-Partenkirchen this summer, attended by 200 machine and particle physicists, provided a timely focus.

With the goal of exploiting conventional technologies for attaining electron-positron energies in the TeV region, the workshop was the fourth in a series. Previous meetings were at SLAC, Stanford (1988), KEK, Japan (1990) and Protvino, Russia (1991). At Garmisch-Partenkirchen, discussion focused on building a machine to attack the 300-500 GeV region, beyond the energies which soon will be opened up once CERN's LEP electron-positron ring is equipped with its full complement of superconducting radiofrequency accelerating cavities.

In addition to working groups on electron-positron sources, damping rings, radiofrequency sources, main linac, and final focus, this year's meeting saw the introduction of four new working groups – critical comparison of machine proposals, design of experiments, work towards a superconducting machine, and instrumentation.

With a view to finding the best technical solutions for the 500 GeV machine, technology groups had lively discussions comparing engineering solutions for the various components under study at different Laboratories. As Maury Tigner put it, 'it is manifest that the competition of ideas that took place has already made considerable improvements in the various approaches'. Superconducting machine studies by the TESLA (TeV Superconducting Linear Accelerator) collaboration are now included in general linear collider technology discussions.

The work of the instrumentation group was based on the important lesson learned at Stanford's SLC linear collider that good monitoring and feedback systems are needed for the control necessary to achieve reliable and stable operation.

The experimentation group looked at various detector designs and physics issues and their relation to the machine design. New theoretical and experimental progress in understanding the 'minijet' background (due to quark/gluon jets from subsidiary photon-photon collisions accompanying the main electron-positron collisions), together with the introduction of multibunch operation, seem to be significantly reducing this problem.

The important machine feature of being able to accommodate two interaction regions, indispensable for scientific cross-checking, was addressed for the first time. The physics case for 300-500 GeV operation was reviewed positively and it was stressed that the energy of such a machine should be upgradable to around 1 TeV.

	TESLA	DLC (D-D)	NLC (SLAC)	JLC (KEK)	VLEPP (P/N)	CLIC (CERN)
Collision Energy (GeV)	500	500	500	500	500	500
Gradient (MV/m)	25	17	38	28	96	80
Active Length (km)	20	30	14	17	6.4	6.6
Frequency (GHz)	1.3	3	11.4	5.7	14	30
Pulse rate (Hz)	10	50	180	150	300	1700
Bunches per pulse	800	172	90	72	1	1-4
Luminosity ($10^{33}cm^{-2}s^{-1}$)	8	4	9	9.7	12	.8-3.2

Examples of electron-positron linear collider projects now being studied. The TESLA collaboration (CEN Saclay, CERN, Cornell, Darmstadt. DESY, INFN Frascati and Milan, Wuppertal) is looking at a superconducting radiofrequency solution. D-D stands for DESY-Darmstadt, P/N for Protvino-Novosibirsk.

Finally the design parameter comparison group began to prepare for a convergence of conceptual design reports in 3-5 years, when a realistic proposal could be launched.

These discussions strengthened the collaboration between the various groups around the world and consolidated the groundwork so that the ongoing research and development programme can continue to proceed coherently. Next year's workshop will be held in SLAC in October.

From Ron Settles & Guy Coignet

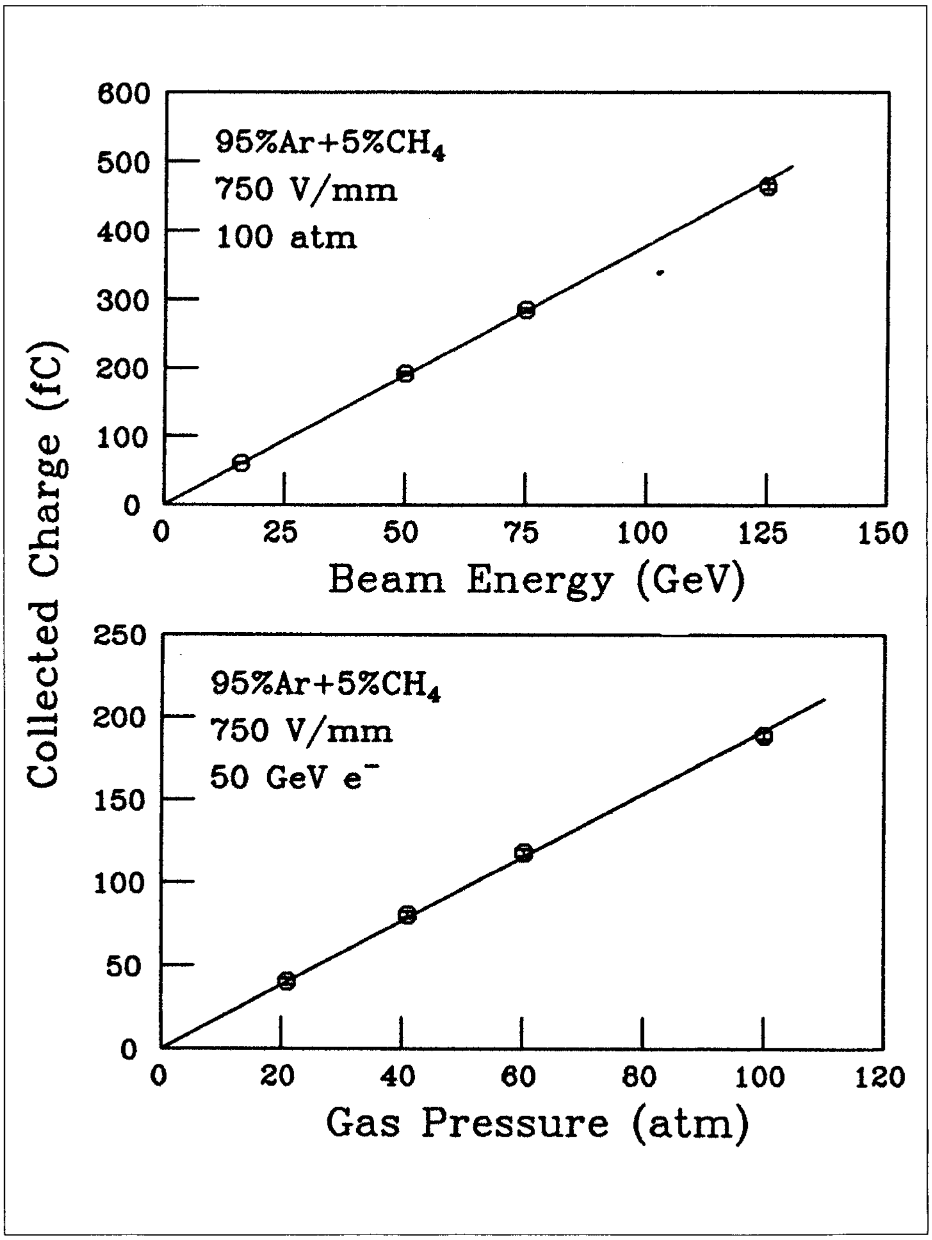
High pressure gas – a new approach to calorimetry

The high particle collision rate and radiation levels in detectors at the new high energy high luminosity proton colliders (SSC, LHC, UNK) put stringent demands on the design of detector components. In particular the forward calorimeters will have to deal with particle fluxes in excess of 4×10^6 per sq cm per s and high radiation doses (at the MGy level).

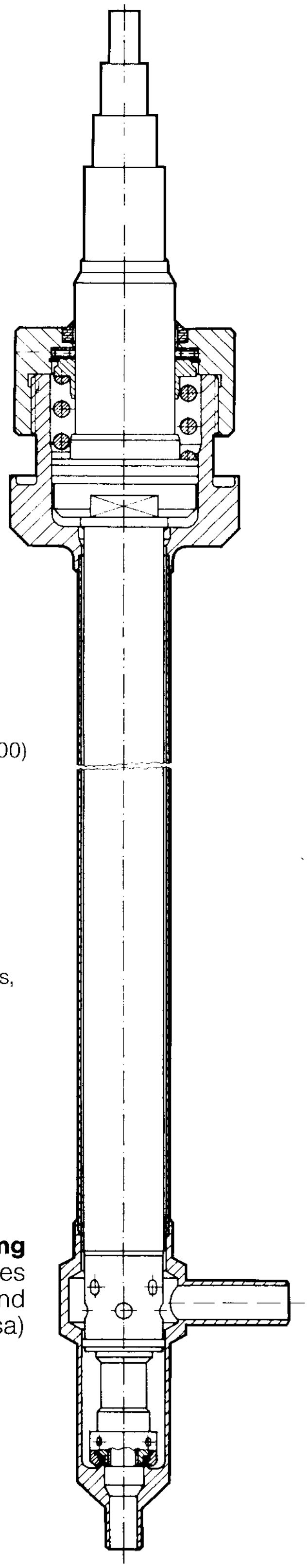
Traditional calorimetric techniques using scintillator, liquids or gases at one atmosphere as sampling medium, might not work in this demanding forward region. In the search for a new approach, several groups in Russia and the US have been investigating the possibilities of gas under high pressure, an inexpensive solution offering several advantages (radiation resistance, no cryogenics, fast response,....).

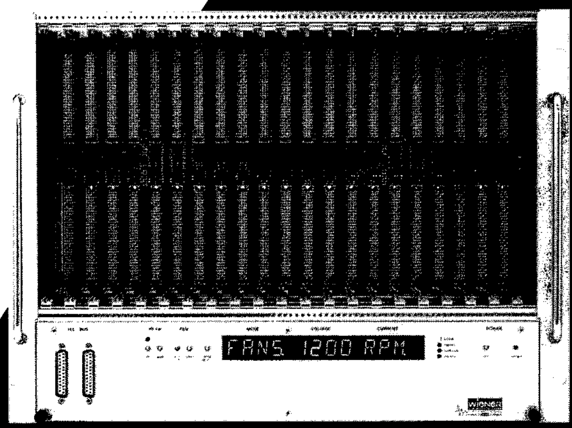
The first investigation of a multi-plate, total absorption, high pressure ionization spectrometer was done by a Soviet group led by Dolgoshein in 1978, and subsequent research and development work for electromagnetic calorimeters pushed ahead in the USSR and at CERN, led by Chris Fabjan. The growing awareness of the challenges for detectors at the next generation of proton colliders intensified this effort.

In 1988, a Rockefeller/Fermilab/Wisconsin/Rochester collaboration studied the physics of signals produced by an americium source in argon and argon-methane gases at 100 atmospheres. They found that the collected signal is insensitive to oxygen contamination up to 80 ppm and that the electron drift velocity in a



Results from a 1991 test at Fermilab of a prototype electromagnetic calorimeter using high pressure gas and built by a US-Dubna group. The collected charge plotted against beam energy (top) and gas pressure (bottom) shows excellent linearity.





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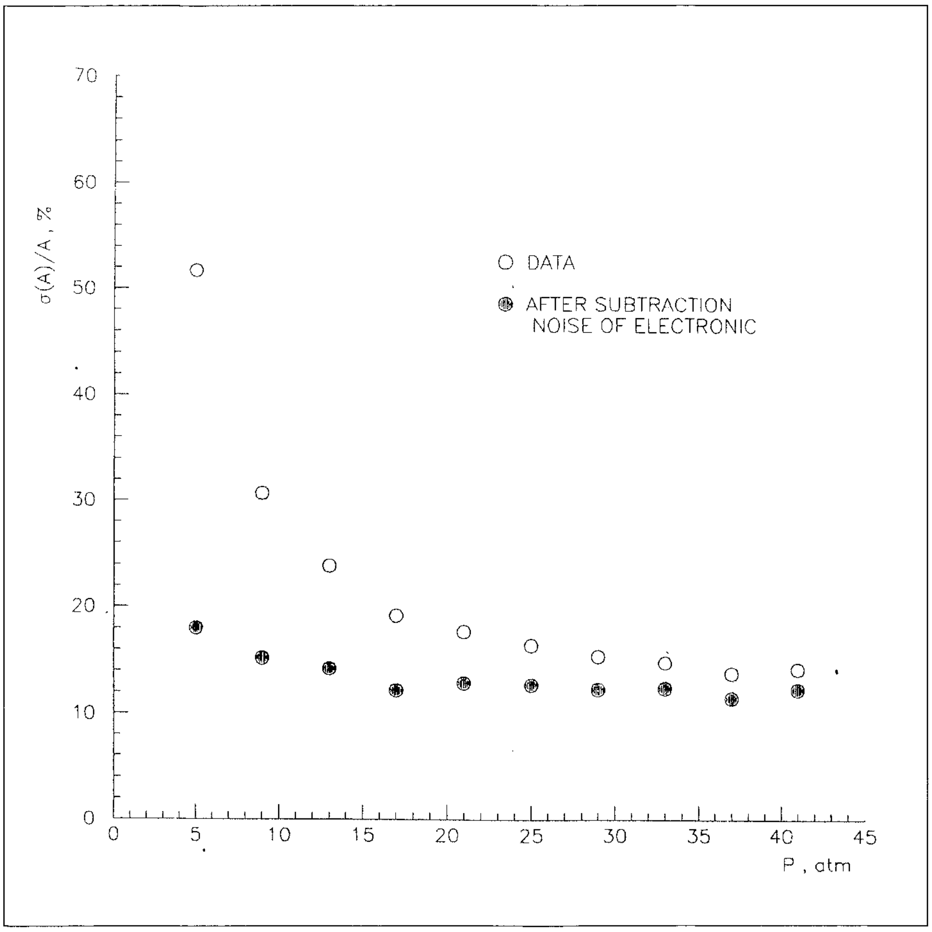
Performance of a gas-filled hadron calorimeter measured by a group at the Institute for High Energy Physics, Serpukhov, showing how the signal-to-noise ratio improves dramatically when the device is operated at high pressures.



99% argon + 1% methane gas mixture is five times larger than in liquid argon or in 2,2,4,4-tetramethylpentane (TMP).

Based on these findings, they proposed that a very fast, high pressure gas calorimeter, extremely resistant to radiation, could be built provided that the mechanical problems associated with high pressure were solved. At about the same time a Dubna-Serpukhov group built and tested a parallel plate electromagnetic calorimeter enclosed in a high pressure vessel. The test was performed with argon and xenon gas mixtures at 20 atm. The energy and spatial resolution obtained were in good agreement with the expected values.

In the autumn of 1990 the US and Dubna groups joined efforts and, with financial support from the Texas National Research Laboratory Commission, designed and built a parallel plate electromagnetic calorimeter. This calorimeter, with 2 mm gas gaps, was tested at Fermilab last fall with a variety of gas fillings in the pressure range 20 to 100 atm and in the energy range 16 to 125 GeV. It proved to be easy to operate, gave excellent linearity with pressure and beam momentum and an energy resolution agreeing with a simulation prediction. The charge collection time for the 100 atm 95% argon + 5% methane mixture is 20 ns/mm. For a calorimeter with 1.5 mm gas gaps, the full width of the signals will be about 30 ns, very similar to scintillator-based calorimeters.

Meanwhile a group under Sergei Denisov working at the Institute for High Energy Physics, Serpukhov, near Moscow, and using a sandwich-type configuration has recently produced the first experimental proof of hadron calorimetry with gas ionization. With a low cost 95% argon, 5% CF_4 mixture under pressures ranging from 5 to 40 atm, using two different arrangements of uranium and iron plate absorbers, and comparing response to hadron and electron beams, the group has obtained encouraging energy resolutions. This initial work suggests that performance improvements would follow from an optimized configuration (thinner plates, improved electronics, denser gases).

Also at Serpukhov, a group led by A. Vorobyov is actively investigating a design using cylindrical electrodes.

The US-Dubna group, headed by Nikos Giokaris, is presently constructing a 'spaghetti' type hadronic calorimeter. The gas is contained in 3/8 inch tubes and the charge collected by 1/4 inch diameter rods at the tube centres. Low cost, inherent radiation hardness and signal speed make this type of calorimeter an attractive option for the forward region of the new collider detectors. Simulations of the hadronic resolution predict a stochastic term of 60% and a constant term of about 5%.

This technique is now accepted by the SDC collaboration at the SSC as a candidate for its forward calorimeters and is being looked at with interest by several other major ongoing detector projects.

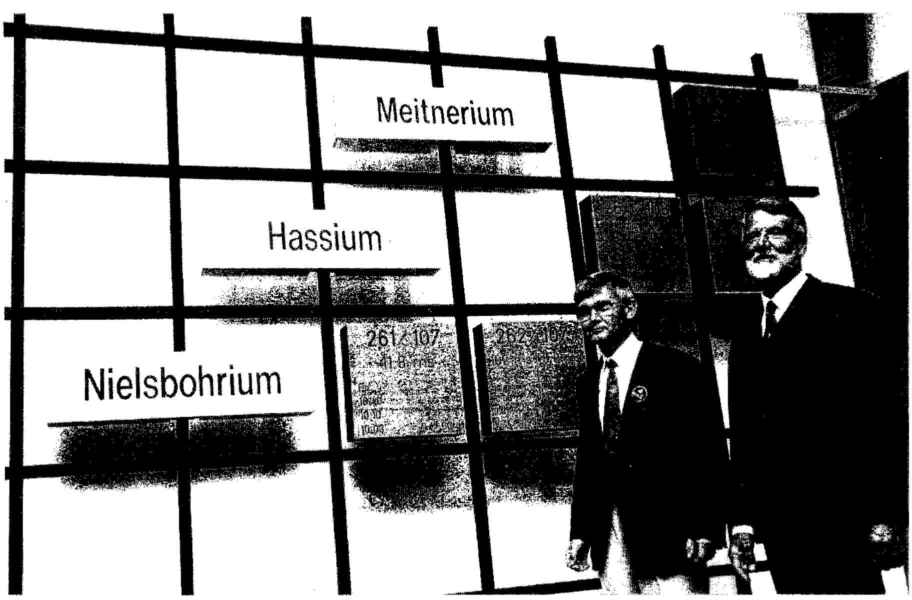
SUPERHEAVY ELEMENTS
Nielsbohrium, hassium and meitnerium

An international commission set up by IUPAP and IUPAC (International Union of Pure and Applied Physics/ Chemistry) in 1987 and chaired by Sir Denys Wilkinson has published its findings on the status of the transfermium elements (beyond atomic number 100) and the credit for the various discoveries.

The discovery of the three heaviest elements, 107, 108 and 109, is attributed to Darmstadt's GSI heavy ion Laboratory, in work carried out between 1981 and 1984 by a group led by Peter Armbruster and Gottfried Münzenberg. After a proposal was submitted to IUPAC, the elements were formally named at a GSI ceremony on 7 September.

Following a proposal from the Russian Dubna Laboratory, element 107 was named nielsbohrium, 108 hassium (after the Latin name 'Hassia', for GSI's home state of Hesse) and 109 meitnerium in honour of nuclear fission pioneer Lise Meitner (1878-1968).

In the commission's findings, discovery of the element 101 (mendelevium) is attributed to Berkeley, 102 (nobelium) to Dubna, and 103 (lawrencium) to a decade of work at Berkeley and Dubna. The credit for element 104 (kurchatovium or rutherfordium) and 105 (provisionally called hahnium) is shared between Berkeley and Dubna. Element 106 (for which no name has yet been proposed) was found by Dubna and by Berkeley/Livermore teams, with the Russian Laboratory given special credit.



Peter Armbruster (right) and Gottfried Münzenberg, leaders of the group which discovered elements 107, 108 and 109 at Darmstadt's GSI heavy ion Laboratory from 1981-4. At a GSI ceremony on 7 September, these respective names for these elements were formally adopted as nielsbohrium, hassium (after the Latin name 'Hassia', for GSI's home German state of Hesse) and meitnerium in honour of nuclear fission pioneer Lise Meitner.
(Photo Achim Zschau, GSI)

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First European Workshop on Beam Instrumentation and Diagnostics for Particle Accelerators

This workshop will be held from 3 to 5 May, 1993, in Montreux, Switzerland. It will give specialists, active in the conception, building and use of beam instrumentation, the opportunity to exchange ideas and share their experience. There will be plenary sessions, with invited presentations and two or three parallel sessions will focus on specialized topics. The following areas of interest have been selected by the Programme Committee:

- Review of instrumentation for particular machines
- Diagnostics for very low intensity beams
- Diagnostics for observation of instabilities
- Diagnostics for superconducting accelerators
- Profile measurement on circulating beams
- Performance of beam position measurements
- Beam loss detection
- Fast on-line data treatment
- Video image processing

Attendance will be limited to about eighty, to favour a workshop atmosphere with ample discussion. Abstracts for contributed papers and requests for invitations are to be submitted by 20 December, 1992, to the workshop secretariat:

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Phone: Ch. Parthé, CERN-SL, No: +41-22-767 4619
Mail: Ch. Parthé, CERN-SL, CH 1211 Geneva 23
Fax No: +41-22-782 2850

(In error, the CERN Courier ran the wrong ad in the September 1992 issue. The position which was advertised no longer exists. We apologize for any inconvenience you may have incurred.)

People and things

Next Director General of CERN proposed

After discussions in CERN's Committee of Council, Christopher Llewellyn Smith, currently Chairman of Physics at the University of Oxford, UK, and of CERN's Scientific Policy Committee, will be proposed at the December meeting of Council, CERN's governing body, for appointment as the Laboratory's Director General to succeed Carlo Rubbia, whose current mandate ends in December 1993. If this proposal is supported at the December meeting, he will take up his duties as from 1 January 1994.

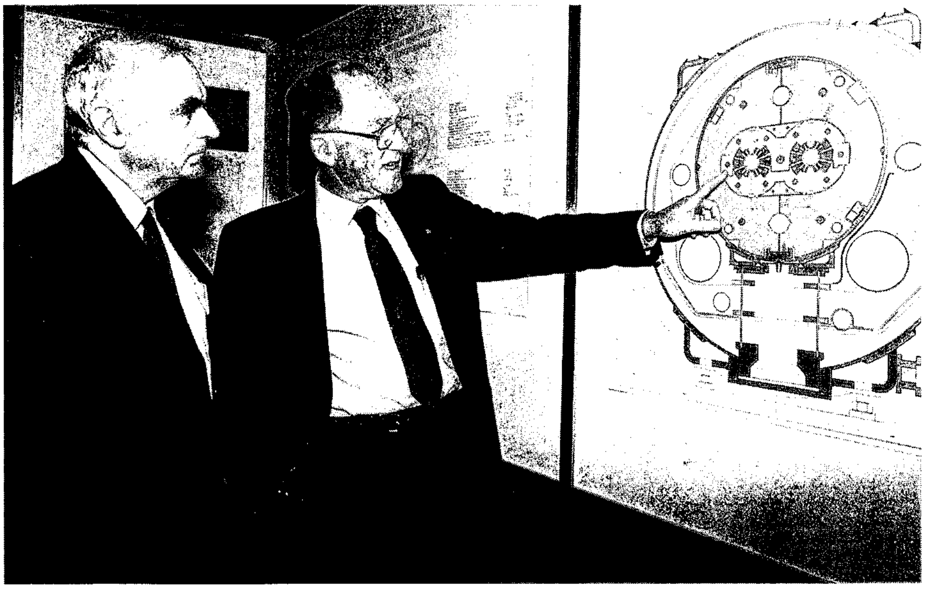
On people

Joseph Rotblat and Hans Bethe are joint winners of this year's prestigious Albert Einstein Peace Prize.

Dennis W. Barnes, former associate vice president for governmental relations at the University of Virginia, becomes president of Southern Universities Research Association (SURA), succeeding William A. Wallenmayer. SURA is the governing body of the CEBAF Continuous Electron Beam Accelerator Facility, now nearing completion in Newport News, Virginia.

Owen Lock 65th birthday

Friends of Owen Lock gathered at CERN on 8 September to pay tribute to the contributions he had made to the life of the Laboratory for over thirty years. His interest in teaching and his great ability as an organizer marked almost all aspects of his career. Arriving as an expert in the



French Research and Space Minister Hubert Curien (left) visited CERN on 15 September. Here CERN's Associate Director for Future Accelerators Giorgio Brianti explains the superconducting magnets for the LHC proton collider to be built in CERN's 27-kilometre LEP tunnel.
(Photo CERN HI23..9.92)

nuclear emulsion detection technique in 1959, he moved on to initiate the CERN Schools and the summer student programme. During a spell in the Personnel Division he did much to develop the Fellows and Visitors scheme which led to decades of involvement in CERN relations with the non-Member States, particularly in Eastern Europe and China, where CERN kept the door open to the scientific communities through the most difficult days of the cold war. It was a special pleasure for Owen to see Poland, Czechoslovakia and Hungary join the Organization in recent years. Among his other roles were secretary of the International Committee for Future Accelerators and many years as assistant in the CERN Directorate. His calm, conscientious and discreet work has been of great value to the Laboratory.

HEPAP

The US High Energy Physics Advisory Panel (HEPAP) makeup is: Stanley G. Wojcicki (Stanford, Chairman), Edmond L. Berger (Argonne), Jonathan M. Dorfan (SLAC), Gary J. Feldman (Harvard), Mary K. Gaillard (Berkeley), Frederick J. Gilman (SSC), Robert J. Gluckstern (Maryland), Donald L. Hartill (Cornell), Laurence S. Littenberg (Brookhaven), Claudio Pellegrini (UCLA), Pierre Ramond (Florida), Don D. Reeder (Madison), Melvyn J. Shochet (Enrico Fermi Inst.), A.J. Stewart Smith (Princeton), Alvin V. Tollestrup (Fermilab), Michael S. Witherell (Santa Barbara).

More Crab gammas

The 'Thermistocle' CERN-France collaboration using an array of 18 Cerenkov telescopes 1650 metres up in the Pyrenees near Perpignan has seen multi-TeV gamma rays from the Crab nebula and has charted the

Background, left, a solar gamma-ray detector at a former solar power plant 1650 metres up in the Pyrenees near Perpignan, France, where 18 of the 200 or so collectors have been replaced by parabolic mirrors with a photomultiplier at the focus. With this array, the 'Thermistocle' CERN-France collaboration has seen multi-TeV gamma rays from the Crab nebula and has charted the energy spectrum of the source over the range 3-20 TeV.

energy spectrum of the source over the range 3-20 TeV.

Working at a former solar power plant, the team has replaced 18 of the 200 or so collectors by parabolic mirrors with a photomultiplier at the focus. Monitoring of the sky began in September 1990.

Ultra-high energy gammas from the Crab region were first found in 1971, and since then a number of gamma emitters have been located (July, page 20).

Schrödinger paperback

Now available in paperback from Cambridge University Press (ISBN 0 521 43767 9) is Walter Moore's scholarly book 'Schrödinger, Life and Thought', which received considerable acclaim in its original hardback edition. Moore traces in detail the career of this unconventional polymath, who had already achieved considerable success before his historic formulation of wave mechanics in 1926 at the age of 38.

Erwin Schrödinger once said 'In my scientific work (and moreover also in my life) I have never followed one line, one programme defining a direction for a long time'. Initially he concentrated on careful experiments in a wide range of fields. When he became Professor at Zurich in 1921, he was described as having 'versatility...in mechanics, optics, capillarity, conductivity, magnetism, gravitation and acoustics.'

As well as physics, science, philosophy and World War I, the book deals amply with Schrödinger's legendary sex life and offbeat marriage. It describes particularly well how the troubled genius shuttled from one university post to the next in the 1930s, tossed like a cork in the stormy international politics of the period.

Quantum Field Theory by Lowell S. Brown, Cambridge University Press (ISBN 0 521 40006 6)

From elementary particles to condensed matter, quantum field theory is the basic tool for working out the details of the microcosmos. This book, well written, pedagogical and well timed, uses language understandable to a wide spectrum of physicists (writes Dimitri Nanopoulos). It introduces and uses, from the outset, modern concepts like path integrals and the renormalization group. By using examples from many-body theory it succeeds in making difficult ideas, such as spontaneous breakdown, intuitively tangible.

The book is timely in that the increasing use and range of applications from elementary particles in condensed matter physics, and vice versa, can make for communication problems. This book provides a substantial step towards a 'unified' approach. The wide selection of interesting problems may also serve as background material for experts. The second volume, dealing with gauge theories, will be most welcome.

Pauli-Jung correspondence

A new book (in German) makes public for the first time the fascinating correspondence from 1932-58 between two scientific pioneers – Wolfgang Pauli for quantum mechanics (who died in 1958), and Carl Jung for analytic psychology. Specialists have suspected that these two great minds influenced each other. This regular exchange of letters displays the fascinating interplay between two apparently very different disciplines. Wolfgang Pauli und C.G. Jung, Ein Briefwechsel 1932-58, edited by C.A. Meier, published by Springer-Verlag (ISBN 3-540-54663-4).

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The CERN Pauli Committee during its meeting in August. This committee looks after the Pauli archives entrusted to CERN and oversees the publication of Pauli's scientific correspondence (by Springer-Verlag). Volume III is to appear soon. Left to right, Victor Weisskopf, Roswitha Rahmy (Secretary), Maurice Jacob, C. Enz and H. Primas. Weisskopf and Enz were, respectively, the first and last assistants of Pauli at Zurich. Roswitha Rahmy is holding the newly-published volume of correspondence between Pauli and psychology pioneer C.G. Jung (see page 31).

SSC R&D magnet reaches 9.5 tesla

As the magnet programme for the US Superconducting Supercollider (SSC) moves into its industrial phase, interesting results are still coming from the final phases of magnet research and development work. Recently Fermilab built and tested a full-length R&D SSC magnet very similar to the baseline dipole, differing only in details of insulation and adhesive. Although it trained a little at temperatures from 2.3 to 4.4K, when the helium reached superfluid temperatures (1.8K), the magnet went to very high currents. After three training quenches it reached a plateau 9.5 tesla at nearly 10,000 amps, approximately 95% of the short-sample limit. (For comparison, 6550 amps and 4.35K are required to produce the SSC design dipole field.) The high-current test result underscores confidence in the mechanical design, because forces on the windings go up as the square of the current.

SPECIAL ANNOUNCEMENT

FOR IMMEDIATE RELEASE: June 21, 1992

FOR MORE INFORMATION, CONTACT: John McDonough
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