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BY THE DIRECTOR-GENERAL

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PAR LE DIRECTEUR GENERAL
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I. RESEARCH DIVISIONS

- Theoretical Physics Division
- Experimental Physics Division
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While the Theoretical Physics Division has continued its tradition of a broad range of research activity, two trends have emerged in recent work by members of the Division. One of these has been the study of gauge theories on a lattice, and the other has been supersymmetry.

Conventional QCD perturbative techniques, useful for describing high-momentum transfer processes and still an active topic of research in the Division, fail for problems where the coupling becomes strong, such as the calculation of hadron spectroscopy. While other methods of attacking the strong coupling region in QCD are being attempted, one of the most promising techniques seems to be putting the gauge theory on a lattice. The scope of investigations in lattice gauge theories has changed somewhat in recent months. All the results obtained here recently are for directly relevant non-Abelian gauge models or for QCD itself, including the quark degrees of freedom.

By combining variational methods with Monte Carlo simulations, significant new results were obtained for the mass gap in SU(2) and SU(3) gauge theories. There are also preliminary results on the glueball spectrum. According to these results, the lowest lying glueball is quite light (900 ± 300 MeV), while the excited states begin much higher.

There has recently been a breakthrough concerning the calculation of the hadron spectrum on the lattice. Different methods, like the hopping parameter expansion combined with Monte Carlo, and the direct Monte Carlo method, have been followed by groups in the Division. Meson masses and baryon masses were determined and predictions for the current quark masses were obtained. For the meson spectrum and quark masses, the different methods give consistent results in surprising agreement with the experimental numbers and current algebra expectations, respectively. The results on the baryons are poorer in quality. Much work still needs to be done before the basic question "is QCD capable of describing the spectroscopical data?" can be answered.

Although members of the Division have also been working on phenomenological aspects of the weak interactions, much interest is now focused on the conjectured "grand unification" of strong, weak and electromagnetic interactions. Grand unified theories encounter problems associated with elementary scalar fields, and the possibility that some or all of the apparently "elementary" particles are in fact composite
has received considerable attention. As an alternative, elementary scalar fields find a natural place in supersymmetric field theories of the type discovered in the Theoretical Physics Division in 1973 and developed extensively in subsequent years. Supersymmetry alleviates many of the technical difficulties encountered in constructing GUTs, and is now the object of increased theoretical and phenomenological attention.

Since supersymmetry requires bosons and fermions of equal masses if it is exact, it must be broken in some way, and members of the Division have proposed models in which supersymmetry is broken either spontaneously, dynamically, or by explicit "soft" terms in the Langrangian. Strategies for breaking grand unified gauge symmetries, while maintaining supersymmetry, have also been developed, and the behaviour of supersymmetry at finite temperature has also been studied. This is relevant to the application of supersymmetric grand unified theories to the cosmological generation of baryons, which has also been the subject of several investigations. This problem involves the violation of CP invariance, which has also been reanalysed in the context of supersymmetric theories.

In parallel to this phenomenological work, there have also been many studies of more technical problems in supersymmetric theories, including the completion of a new formulation of the N = 8 supergravity theory. Supersymmetric theories have fewer ultra-violet divergences than conventional field theories, and are often formulated by starting from a theory defined in a higher number of space-time dimensions. These aspects of supersymmetric theories have also been actively investigated in recent months.

There is considerable optimism among theorists that supersymmetry is relevant to physics, though it must be admitted that there is as yet no experimental evidence to support this belief. However, members of the Division were active in organizing and participating in a recent workshop meeting with experimentalists on possible tests of supersymmetry. Many interesting possibilities for the future experimental programme of CERN emerged from discussions at this meeting.
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1. INTRODUCTION

Since January 1982 a number of major new experiments have come into full operation at the SPS. Also many interesting results have been reported from the analysis of data recorded in 1981 or earlier.

2. p+p COLLIDER PROGRAMME

The Aachen-Annecy (LAPP)-Birmingham-CERN-London (QMC)-Paris (Collège de France)-Riverside-Rome-Rutherford-Saclay-Vienna Collaboration (UA1) have measured the single-particle $p_T$ distribution determined with their central detector. Comparing the data, which show a $p_T^{-5}$ dependence, with a QCD model calculation, they find satisfactory agreement. Using their luminosity detectors they have determined a preliminary value of $b = 13.8 \pm 1.5$ GeV/c² for the slope parameter describing pp elastic scattering in the range $0.16 < t < 0.24$ GeV/c². Within the experimental errors this fits well to a logarithmic extrapolation from lower-energy data.

The Berne-CERN-Copenhagen-Orsay-Saclay Collaboration (UA2) have collected data with an integrated luminosity of some 80 inverse nanobarns. The detector works according to expectations — in particular, collision vertices are reconstructed to within 2 mm and the calorimeter calibration is better than 3%. Topics they are investigating include: i) a measurement of the invariant cross-section for $p\bar{p} + \pi^0 + X$ in the range $1.5 < p_T < 4.5$ GeV/c; the two photons from the $\pi^0$ are resolved and measured separately; ii) a limit on the production of light particles with charge below 0.77e; iii) particle ratios ($\pi,K,p$) with $p_T < 1$ GeV/c.

The Amsterdam-CERN-Genoa-Naples-Pisa Collaboration (UA4) have analysed the $t$ distribution of $p\bar{p}$ elastic scattering at the collider. They have presented results in the range $0.06 < |t| < 0.18$ (GeV/c)² from some 2000 measured events taken in a special normal $\beta$ run. Their preliminary value for the slope parameter $b$ in this $t$ range is $17.2 \pm 0.8$ GeV/c², where the error is only the statistical error.

The Bonn-Brussels-Cambridge-CERN-Stockholm Collaboration (UA5) have measured about 2500 complete streamer chamber events. They have reported results on the rapidity distributions and multiplicities of 8000 electromagnetic showers. They have reported their results of a first search at the collider for collisions akin to the cosmic-ray Centauro events. In a sample of 3500 analysed minimum bias events, they have no evidence for collisions of that nature. They have also reported preliminary results on K-meson production.
3. **ISR PROGRAMME**

3.1 *pp, φ collisions*

Two groups have recently completed their analysis of φ collisions searching for deviations from the behaviour expected from the collision of the individual nucleons. The BNL-Cambridge-Copenhagen (NBLC)-Lund-Pennsylvania-Rutherford-Tel Aviv Collaboration (R807) have investigated 63 GeV-63 GeV φφ interactions with very high central multiplicity. They find that they can interpret the results as arising from individual nucleon processes. The CERN-Heidelberg-Lund Collaboration (R418) have compared the transverse momentum distributions of hadrons produced in central φφ, and φ collisions with those produced in pp collisions. They find their results consistent with enhancements of factors of 16 and 4, again as expected from the addition of single nucleon collisions.

3.2 *pp collisions*

R807 have also completed a measurement of the production of the vector mesons ρ°, K°*, K°, and φ in 31 GeV - 31 GeV pp collisions. They find these to be in reasonable agreement with the prediction of a quark model for these processes, and conclude that 60% ± 15% of all pseudoscalar mesons observed are the decay products of vector mesons.

4. **SPS FIXED-TARGET PROGRAMME**

4.1 *Neutrino experiments*

From measurements of antineutrino scattering, the CERN-Dortmund-Heidelberg-Saclay (CDHS) Collaboration (WA1) have derived an improved limit on right-handed weak quark currents. They find σ_{right}/σ_{left} < 0.009 with 90% confidence.

The CDHS Collaboration find that the scaling violations of the structure functions observed by them are adequately described by QCD but not by other possible field theories of strong interactions. They have also found evidence for the neutral coupling of charmed quarks by detecting the diffractive production of ψ mesons in neutral-current neutrino interactions. The cross-section for the process is \( \sigma_{\text{diff}} = (4.2 \pm 1.5) \times 10^{-4} \text{ cm}^2/\text{nucleon} \) at \( E_\nu \sim 60 \text{ GeV} \), in agreement with \( Z^0 \) gluon fusion models but at variance with vector dominance calculations.

The CERN-Hamburg-Amsterdam-Rome-Moscow (CHARM) Collaboration (WA18) have obtained a more precise value of \( \sin^2 \theta_W \) in the lepton sector from the ratio of \( \sigma(\nu_e) / \sigma(\bar{\nu}_e) \), confirming the universality of the neutral-current coupling. They have also derived new results on the structure of the weak charged current from studies of the muon polarization, of the inverse muon decay process, and of trident production.

The Aachen-Bonn-CERN-Munich-Oxford Collaboration (WA21) have results from testing the quark model by comparing the charge and energy distributions of the hadronic systems produced in νp and νp scattering in
BEBC. Tests confirming models of quark fragmentation have been obtained from the values of the current jet charges measured by the ratio of the charge flow to the energy flow.

The new beam-dump facility built at CERN has been successfully commissioned and was run in March 1982 in conjunction with the upgraded neutrino detectors. Technical difficulties have resulted in a delay in completing the programme.

4.2 Muon and photon beams

The Aachen-Annecy (LAPP)-CERN-Freiburg-Hamburg-Kiel-Lancaster-Liverpool-Mons-Munich-Orsay-Oxford-Rutherford-Sheffield-Turin-Uppsala-Wuppertal Collaboration (EMC) are continuing with the analysis of their measurements. The data which indicated characteristics of QCD-like modifications to the quark parton model are being further analysed with high statistics, and an improved understanding of the high internal quark momentum is developing. The azimuthal distribution of single hadrons about the virtual photon direction is also providing a further measure of QCD effects. The data are suitable for detailed investigation of the fragmentation process and, in particular, clear signals of inelastic $\rho^0$, $K_S^0$, and $\Lambda$ production have been seen.

The Athens-CERN-London (IC)-Orsay-Palaiseau (EP)-Paris (Collège de France)-Saclay-Southampton-Strasbourg-Warsaw Collaboration (NA14) photo-production experiment is now entering its data-taking phase. Very preliminary results from test periods, on $\pi^0$ inclusive yields seem to show a difference of behaviour in $p_T$ between $\pi^-$-induced and $\gamma$-induced reactions. From the $\gamma$ inclusive spectra they deduce that the $\pi^0$ will not be a major background to QED Compton scattering.

4.3 Hadron beams

The CERN-Orsay-Palaiseau-Paris (Collège de France)-Pisa-Saclay Collaboration (NA3) find from their muon pair data that the intrinsic transverse momentum of the quarks in the pion is $\langle p_T^2 \rangle \approx 0.75 \ (GeV/c)^2$. They are now taking data to detect direct photon production in a beam of $2 \times 10^7$ pions per burst.

The CERN-Palaiseau (EP)-Strasbourg-Zurich (ETH) Collaboration (NA10) are now taking data. They have been able to accept a beam intensity of $\approx 10^9 \pi$ per burst, and should therefore be able to meet their physics goals.

The Amsterdam-Brussels-CERN-Madrid-Mons-Nijmegen-Oxford-Padua-Paris VI-Rome-Rutherford-Serpukhov-Stockholm-Strasbourg-Trieste-Turin-Vienna Collaboration (NA16) have measured and analysed some 40% of the 1980 pictures taken in their high-resolution hydrogen bubble chamber. They have new results on the lifetimes of the $D^0$, and $D^\pm$ charmed mesons, and have examples of a $\Lambda^+$ decay and an $F^-$ decay. The experiment continues as NA27 with improved bubble chamber optics, and better particle identification with ISIS. Some 250 000 bubble chamber photographs have been taken with the improved set-up.
The Berne-Munich (MPI) Collaboration (NA18) have continued analysis of their high-resolution heavy-liquid bubble chamber photographs. They find a cross-section of $\sigma = 24.5 \pm 9 \mu b$ per nucleon if they assume $\sigma \sim A^{1.3}$ for 340 GeV incident $\pi^-$. Their data favour a linear dependence of $\sigma$ upon $A$ for the cross-section.

The Amsterdam-Bristol-CERN-Cracow-Munich (MPI)-Rutherford Collaboration (NA11) have installed six high-resolution silicon strip counters in their experiment and are now recording data measuring charm production with $\sigma = 4.5 \mu m$ spatial resolution.

The CERN-Neuchâtel-Palaiseau (EP)-Paris (Collège de France) Collaboration (WA56) have completed the analysis of data, searching for the backward production of narrow $pp$ states (baryonium). They investigated $\pi^-p + p\pi^-p\bar{p}$ at 12 GeV/c and $\pi^-p + p\pi^-p\bar{p}$ at 20 GeV/c, and have found the 99.8% C.L. upper limit to the cross-sections to be in the range from 2 to 8 nb, depending on the quasi-two-body channels involved.

The CERN-Liverpool Collaboration (WA49) have searched for baryonium states using the Omega Prime spectrometer. They separate channels not previously resolved, and find upper limits for $(\bar{p}p) + \bar{p}p\pi^0$ of 36 nb and $(\bar{p}p) + \bar{p}p(\omega^0$ or $f^0)$ of 80 nb for containing a 2.2 GeV baryonium state.

5. PS PROGRAMME


An upper limit of $\sim 10^{-7}$ will be forthcoming for $\mu_{30Na}$, and the existence of $^{35}Na$ is confirmed. Three new isotopes, $^{53}K$, $^{51}Ca$, and $^{54}K$, have been identified, half-lifetimes being measured for the first two.

5.2 PS166: Heidelberg (MPI and University)-Saclay (CERN) Collaboration. Sigma hypernucleon states using the kaon beam $K_{24}$.

The studies of narrow states $^{11}B_{\Sigma^+}$ and $^{11}B_{\Sigma^-}$ continues. A preliminary analysis of the data indicates a spin-orbit splitting in p-shell $\Sigma$ hypernuclei of the same order of magnitude as in $\Lambda$ hypernuclei. This result is in accord with the basic quark model of such systems.

5.3 LEAR experiments

Tests, developments, and construction of the 16 accepted experiments are under way and are going according to plan to meet the LEAR machine schedule.
6. SC PROGRAMME


The μSR wire chamber spectrometer provided good performance with regard to time and space correlation of events.

The magnetic phase transition in the weakly anisotropic antiferromagnet MnF₂ crystal was studied using μ⁺ spin as a local probe of the critical fluctuations. Precission experiments near the Neel temperature show the critical damping and its angular dependence, thus indicating that muons thermalize in crystallographically coherent sites.

Regarding the muonium chemistry experiments, big changes in the hyperfine interaction of muonium adduct radicals were observed in solutions of organic compounds as a function of the relative concentrations.

6.2 SC87: Berkeley-Cornwallis-Studsvik Collaboration.

Heavy target fragmentation in intermediate-energy heavy-ion reactions.

Studies of the fragmentation of Ho, Ta, Au, and U nuclei by heavy ions of energies 20-107 MeV/u have continued. In the interaction of 45-400 MeV/u heavy ions with Au, fission-like events giving rise to fragments with A = 80-140 arise from collisions in which excitation energies of 200-250 MeV have been deposited in the target nucleus, independent of beam energy. The light fragment (A < 50) yields increase linearly with beam energy from 12 to 2100 MeV/u. These fragments appear to arise in a common mechanism in which a large fixed quantity of energy (dependent on beam energy) is deposited in the target nucleus.


Heavy-ion interactions with nuclei.

Isotopic distributions of Na, K, Rb, and Cs produced in Ta and U targets bombarded with ¹²C of 77, 27, and 13 MeV/u. A great similarity is observed between the shape of the distributions measured for the highest energy and those obtained with high-energy protons, indicating that the reaction mechanisms involved are of the same type (fragmentation, spallation, fission). In particular for the U target, the analogy is obvious between the results from 924 MeV ¹²C and those from 1 GeV protons, showing the importance of the total energy rather than of the energy per nucleon. The cross-sections are generally higher with the heavy-ion beam, in particular for the neutron-rich isotopes.

6.4 ISOLDE Collaboration

Most important work towards a determination of the electron-neutrino mass has been pursued by this collaboration. A new upper limit on the νₑ mass has been obtained.

The programme to measure the mass of the electron neutrino continues on the two isotopes ¹⁹³Pt and ¹⁶³Ho. The data from singles and LX-IB coincidences counting on a sample of 10¹⁴ atoms of ¹⁹³Pt have shown
the presence of the enhancement effect predicted by the De Rujula-Glauber-Martin theory. The results give in addition a new Q value for $^{193}\text{Pt}$ of $56.8 \pm 1.0$ keV, and a first analysis gives a new limit on $m_{\nu_e} < 1$ keV (to be compared with the old limit of 4.1 keV).

7. OTHER ACTIVITIES

7.1 Proton lifetime: CERN-Frascati-Milan-Turin Collaboration

The 150 ton detector, with 40,000 limited streamer tubes, is now installed in garage 17 of the Mont Blanc tunnel. The detectors are being conditioned with the correct gas mixture and high-voltage conditions, and a data link from the tunnel to CERN is being installed in the telephonic system.

7.2 Neutron-antineutron oscillations (at ILL Grenoble): CERN-ILL-Padua-Rutherford-Sussex Collaboration

The upgraded detector continued to take data, background conditions having improved by at least 2 orders of magnitude. It seems realistic to envisage a limit on the oscillation period of around $10^6$ s.
EXPERIMENTAL PHYSICS FACILITIES DIVISION

1. ISR PROGRAMME

The Split-Field Magnet Spectrometer (SFM) continued data-taking for experiments R419, R420 and R421. At the Open Axial-Field Spectrometer (OAFS), the installation of the third wall (outer vertical) of the uranium calorimeter was completed, and data-taking for experiment R807 resumed. Experiment R110 was interrupted in March by the failure of a helium compressor crankshaft in the superconducting magnet refrigerator. Despite the serious nature of the damage, the experiment was able to restart in April.

2. SPS AND PS PROGRAMMES

Two main features of the original SPS programme had been the neutrino beam dump experiment in periods 1 and 3, involving BEBC (WA66), WA65 and WA68, and the SPS proton-antiproton collider experiments in periods 2 and 5, involving UA1 and UA2. Because of an incident on the UA1 central detector necessitating extensive cleaning operations, and also because of unforeseen difficulties with the beam dump requiring fundamental modifications to the cooling system, the SPS programme was revised to schedule fixed-target operations of the machine in periods 2, 3 and 4, followed by SPS collider operation in period 5 only. The beam dump experiment will resume in period 3 or 4.

For the experiments concerned, these programme modifications entailed extensive revisions of plans.

BEBC interrupted operation in April, having taken 93,000 pictures in 74% neon-hydrogen mixture for experiment WA66. It is planned to restart the chamber in June/July for a technical run for the development of holographic techniques, followed in July/August by data-taking for the beam dump experiment (period 3/4).

EHS started data-taking for experiment NA27 in March, using the particle identifier ISIS II, 44 wire chamber planes, the Silica Aerogel Detector SAD and the Proportional Inclined Chamber PIC. The vertex detector is the bubble chamber HOLEBC, now operating at 30 Hz, employing classical bright-field optics to photograph bubbles as small as 16 micrometres. As a consequence of the new SPS programme, this run was continued in period 2, and in early May the picture total was approaching 900,000. EHS with RCBC will start data-taking for three experiments (NA21, NA22 and NA23) in mid June, but without the benefit of a preliminary technical run.
Omega completed data-taking for experiments WA72 (fast proton production in pion-nucleus interactions) and WA74 (antiproton-proton glory scattering) and started on experiment WA76 (mesons produced centrally in proton-proton and pion-proton reactions). This run will last until June. In July, the West Area Upgrading Programme will begin, involving rearrangement of beam lines and detectors and a displacement of the Omega Spectrometer.

NA10 operated successfully in period 1B and, following the modified schedule, continued operation in period 2.

UA1 is engaged in the previously mentioned cleaning operation of the external part of the central detector, which carries the preamplifiers and the high-voltage distribution system of the drift chambers.

UA2 has postponed, as a consequence of the revised SPS schedule, the closing of the central calorimeter until after the proton-antiproton run in period 5. This operation had originally been planned for period 3/4.

The preparation of the beam line for the neutrino oscillation experiments PS169/180/181, scheduled for 1983, is progressing normally. The experiments require a beam from the PS to the West Area, with a first detector near intersection 1 of the ISR. The new tunnel to the ISR ring and the necessary modifications to one of the ISR filling lines have been completed.

3. DEVELOPMENTS AND LEP ACTIVITIES

The Letters of Intent for LEP experiments submitted to the LEP Experiments Committee in January showed considerable interest in detector technologies developed by EF Division. These developments, started in the context of ISR and SPS experiments, feature technical ideas useful for various central detectors (axial wire chamber and time-projection chamber), for electromagnetic calorimeters (liquid-argon calorimeter and high-density projection chamber) and for microstrip vertex and tagging detectors. The development of the superconducting solenoid magnets proposed in four of the seven Letters of Intent, and of their ancillary cryogenic equipment, is being closely followed with the intention of arriving at a maximum standardization and coordination of concepts and materials.
An EF group has been charged with the provision of the water-cooling and ventilation systems for the LEP ring. Other activities for LEP concern the development of fabrication techniques for components of the vacuum system and for survey instrumentation.

The construction of a five-cell superconducting cavity for LEP, to be tested at PETRA by the end of the year, is in progress. A first cell with three coupling ports gave a quality factor greater than $2 \times 10^3$ and an accelerating field of 5 MV/m with negligible electron loading. The main r.f. coupler has been tested up to 20 kW, and the construction of two higher-order mode couplers is going on. The cryostat has been ordered and should arrive in July. The research on lossy regions producing field breakdown is continued by means of 3 GHz test cavities.

Development work for fixed-target experimental techniques has included technical runs with the holographic freon bubble chamber H0BC (experiment NA25), where the expansion repetition rate could be increased substantially. Technical assistance was given to a group of Ecole Polytechnique, Palaiseau, in development work for a solid-neon or solid-argon calorimeter for use in very large bubble chambers (BEBC size).
DATA HANDLING DIVISION

At the beginning of the year the personnel of the Scientific Information Service and the Publications Group were transferred from the Data Handling Division to the newly created Documentation Department. Their activities are no longer covered by the divisional progress reports.

In the Computer Centre the services offered by the recently installed IBM 3081 were stabilized at a satisfactory level. A record number of 30,000 jobs have been processed in one week, with a use of 440 CPU hours (in IBM 370/168 equivalent). Preparatory work for the installation of the Siemens has started. Activities related to LEP construction or LEP experiments are gaining in importance. Examples are the preparations for a Computer-Aided Design and Manufacturing Service (CAD/CAM) for mechanical construction work, the introduction of a data-base system and the involvement of a number of programmers in the preparations of proposals for LEP experiments.

1. COMPUTER CENTRE
   1.1 CDC service

   The CDC service continues to run at a high level of stability and availability.

   The permanent file bases on MFA and MFB were substantially modernized by the introduction of Fixed Module Drive (FMD) units to replace the very old 844 single density disks, and the introduction of the user set concept.

   1.2 IBM service

   The IBM 3081 and 168 service has been stabilized to a satisfactory level with an availability of above 99% and mean time between interrupts better than 140 hours. Additional disk storage capacity has been introduced (both 3330 and 3350) in order to improve the MSS and disk situation.

   The numbers of jobs run and CPU hours processed per week have reached new record levels of above 30,000 jobs and 439.8 hours (normalized to IBM 370/168 equivalent).

   The new operating system release MVS SP 1.3 has been introduced into service.
The Siemens BS3000 FORTRAN 77 compiler has been installed and extensively tested and will be shortly introduced as a user service.

In order to help users to manage their mass store volumes, a new version of the MSSAUDIT program is being written and a facility for copying complete volumes to tape will be provided. A new version of the SYNTAX command which gives access to the full description of all WYLBUR commands is almost ready to be released. In the area of text processing, work has been done to support extended character sets (including mathematical and national character sets), both on terminals, in SCRIPT, and for the IBM 6670 printer to be delivered shortly. On the accounting side, the revision of the IBM permanent file control scheme has been continued and a WYLBUR data base of accounting data has been developed.

1.3 Data communications

CERNET has continued to provide a reliable and stable data communications service. The software has now been placed on "maintenance-only" status. Six new user computer connections have been made, two remade after a move of the computers, and a node computer moved from the West to the North Area to accommodate increased demand there.

The microprocessor ACC interface has been installed on four Nord 10(0) systems and is performing very satisfactorily. The X-25 Gateway facility has undergone further developments, firstly for the second series of tests being organized by the Swiss PTT for the Telepac network prior to its introduction into public services later this year, and secondly for the setting up of direct X-25 links to the SRC network at the Rutherford Laboratory and to Saclay.

The INDEX system continued to provide around-the-clock remote access to the main computers and to several experiments and development computers, via a large number of terminals scattered over the site.

The restructuring programme of the INDEX system has continued with the upgrade of three PACXs and the suppression of a Mini-PACX. A third PACX for the Computer Centre is due for delivery in May.

Regular operation of the satellite links of the Stella project was temporarily halted during January, while the Swiss PTT transferred the CERN Earth Station to their site at Loèche, after a series of tests of the high-speed data link from there to CERN. Four other Stella stations were in the final check-out and testing phase during this period. The main work at CERN on Stella has been the development of improvements to the system in collaboration with Rutherford and with CNUCE/INFN in Pisa. These will allow access from computers in these laboratories to machines on
CERNET or other local networks in CERN. The work is part of a new collaboration organized and partly funded by the Commission of the European Communities in Brussels.

1.4 General

Preparatory work for the Siemens installation has begun and the first two disks strings are in operation.

The splitting of the CERN Program Library into a multi-layered structure based on the PATCHY source maintenance system has been completed.

The experimental data I/O package (IOPACK) has been extended to support IBM VBS format. The first implementation (IBM only) of the file-access package for physics production book-keeping (KAPACK) has been completed and is now in use by the UA2 experiment. Of the numerical analysis part of the Program Library, about 30 packages for KERNLIB have been revised (partly newly written), tested, documented and put into three PAM-files (work not yet completed). New programs on symmetric matrices have been written and programs for least squares data fitting and maximum likelihood estimation have been started.

A study of the terminal market was made and a tender for a graphics terminal issued. An evaluation of personal work-stations was started. Portable dial-up terminals and a new hardcopy unit are also under evaluation.

The computer-aided design system EUCLID, developed by Matra-Datavision, has been selected for the support of LEP construction and its purchase approved by the Finance Committee. A service based on this system and including the operation of the computers is being organized.

A start has been made on the implementation of data bases associated with the LEP project, using the relation data-base system, ORACLE.

2. DATA PROCESSING

2.1 On-line support for experiments

A second ND-500 system has been installed and integrated in the UA1 data acquisition and control system.

The data acquisition software for the VAX-11/780 computer has been further developed. The new version of the PDF-11 data acquisition software was installed on more user computers. The improved ND-100 data acquisition
software has been successfully field-tested together with the HMINI histogram package. MC 68000 data acquisition software for the UA1 muon trigger has been developed.

At EHS, on-line for all major spectrometer components is now in use and monitoring is being improved. Work continues on the Optical Fiducial Volume Trigger for RCBC. Test data analysis predicts efficiency better than 80% and it should be in use in June. The heated 12 m long Cherenkov produced in collaboration with Madrid is currently being tested. The sophisticated monitoring and display system for ISIS has been satisfactorily commissioned.

2.2 Off-line programming support

The Division has continued to provide off-line support to 12 SPS experiments, to the ERASME system, to the usage of 168/E microprocessors, and to the MERLIN interactive 3D graphics system being used by the UA1 and UA2 experiments.

First development effort has gone into the proposals being written for LEP experiments. In particular, the second generation simulation program GEANT has proven to be particularly successful for the study of LEP experimental designs.

In collaboration with EP Division, a new memory management system has been designed with the aim to replace HYDRA and ZBOOK in the longer term.

2.3 Special processors

Setting up of the off-line pool of 168/E processors has progressed smoothly. Two clusters of two processors each are now in use as well as a test cluster. Since January, 15 million events for SFM, EMC and R807 have been processed, equivalent to some 1200 IBM/370/168 CPU hours. Within three months two 168/E have been produced for on-line filter use at UA1. This involved the integration and testing of Saclay-built 512 Kbyte data memories, and also design and construction of a new read-out controller, inter-processor bus system and memory interface.

Two more MICE microprogrammable engines were built, respectively for experiment R704 and for the Omega Prime facility.

Portable control software for the fast front-end CAMAC processor (CAB) is being developed in collaboration with the Ecole Polytechnique in Paris.
2.4 General

The ERASME computer, a DEC-10, has been replaced by a VAX-11/780, and the life-extending replacement of the ERASME PDP-11 control computers for the measurement tables is now more than half complete and is proceeding on schedule.

The development of the Portable Interactive Language System (PILS) is progressing satisfactorily. The release is planned before the end of 1982.

A start has been made with the study of computer-aided design systems for electronics, capable of resolving the design problems that are likely to be encountered in the LEP machine and experiments.
II. TECHNICAL DIVISIONS

- Proton Synchrotron Division
- Intersecting Storage Rings Division
- Super Proton Synchrotron Division
- Technical Services and Buildings Division
PROTON SYNCHROTRON DIVISION

A. PROTON SYNCHROTRON

1. THE PHYSICS PROGRAMME

1.1 Operation

During the annual long shutdown a large amount of work was done that might, in one way or another, have affected the subsequent start-up of the accelerators and the experimental programme. However, a series of careful checks and tests ensured that there was no delay; the staggering in time of the setting-up procedures for the various customers (in the order: East Hall experiments, SPS, AA, ISR) certainly helped considerably in keeping to the planned programme. Some interesting results were already obtained in the first period (up to Easter); the efficiency of the transfer and acceleration process between AA and ISR was pushed up to 85%, enabling a record stack of 3.84 mA to be obtained at 26 GeV/c (previous highest value was 2 mA). Antiprotons were accelerated for the first time down to 0.64 GeV/c (as will be required for LEAR); moreover, this was achieved using only six shots—less than $10^{10}$ particles in all. The fault rate was 6.2%, largely due to sparking problems on the 750 keV accelerating column of the Linac preinjector, a water leak in the Booster and two mains power failures. During the Easter shutdown installation work for LEAR continued, and extensive tests were made in an attempt to improve the situation on the Linac II preinjector. Planned tests of Linac I could not, however, be completed.

1.2 Experimental areas

The layout surrounding the slowly-ejected primary beam $e_{18}$ in the East Hall was partially reconstructed to provide a new secondary beam ($t_7$) for the "channelling" experiment (PS 188); at the same time several beam transport elements were exchanged and/or overhauled. Experiments PS 166 (search for hypernuclear states) in beam $k_{25}$ and PS 162 (exotic light nuclei) in the primary beam $e_{18}$ continued data-taking; all the other beam lines were available for equipment tests.

A project to expand the planned LEAR experimental area was prepared and approved. This new layout provides six antiproton beams of which three may run simultaneously; the space available has been increased by about 20%. The major change from the previous scheme is an additional beam-sharing ("splitter") magnet. Services are being installed, and beam transport and monitoring equipment is being prepared.
In the transfer tunnels leading to the SPS and ISR additional shielding was installed to allow construction work for the "neutrino oscillations" experiment to go ahead as quickly as possible.

"Mantis", the remotely controlled mobile telemanipulator, was used to install 60 metres of vacuum pipe in the highly radioactive SPS neutrino tunnel. This included drilling, installation and assembly; during the three weeks work the telemanipulator was controlled from a surface building through 350 metres of cable. Later on, "Mantis" was used at short notice to carry out a repair in the beam dump vault, involving cutting out broken sections of water pipe and brazing in new ones.

2. ACCELERATOR DEVELOPMENT

2.1 Linear accelerators

Linac II continued in routine use for PS operation. Its most serious problem arose from oil vapour pollution of the preinjector column. The source of this pollution proved extremely difficult to identify; it seems the most likely origin was the turbomolecular vacuum pumps under certain operational conditions. A good deal of extra effort and some modifications to the 750 kV power supply and to the accelerating column just succeeded in preventing too serious a loss of PS operational time.

Linac I has finally acquired a new vacuum control system and turbomolecular pumps to replace the old mercury diffusion types on the preinjector. In order to know whether acceleration of $\text{O}^{6+}$ ions in the $2\beta\lambda$ mode would be possible or not, an attempt was made to push up the r.f. power levels by 33% in the first accelerating cavity (Tank I). The experiment was successful, but only after thorough cleaning and bake-out of the inside of the tank, the liner and the drift-tubes; the presence of a good deal of plastic materials in the interior meant that the outcome was by no means predictable. Preparations to provide beam for LEAR are well under way.

The control systems of LEAR and Linac I are being integrated with the existing Linac II system, requiring several modifications to the original software. The integrated system will use two minicomputers and two microcomputers in a network providing good back-up facilities. A data link to the Main Control Room is being established. An additional microcomputer is available for program development.

2.2 Booster synchrotron

The Booster has continued to perform its complex task adequately, and beam downtime has now returned to the accustomed figure of $\sim 1\%$. The new energy-saving magnet cycle (see 1981 Annual Report) is now a part of routine operation. Pulsed "shaving" dipoles, fully programmable from cycle to cycle, have been added to the armoury of beam-shaping weapons.
During the shutdown, in addition to routine maintenance and realignment of some accelerator components, preparations were made for installation at a later date of the "second harmonic" r.f. cavities. Construction of the cavities themselves (intended to improve particle distribution within the proton bunches) and their ancillary equipment is going ahead.

An experimental system to automatically evaluate longitudinal emittance using bunch shape and other parameters is now available. A beam current transformer with computer data acquisition has been installed in the 800 MeV measurement line. The special pick-up electrode is in regular use to optimize injection. For the new control system, a major effort is being made to improve operator-machine interaction and to refine recovery procedures after failures.

Machine study periods were rarer than before, and work was therefore concentrated on raising the intensity of two of the four rings, for AA antiproton production, and on the two-by-two combination in the transfer line; this latter technique is available if maximum \( \bar{p} \) production should be needed.

### 2.3 Main proton synchrotron

Irradiation of the synchrotron accelerator ring during 1981, according to measurements made by 100 dosimeters as well as levels of induced radioactivity, fell back to the relatively low level recorded in 1979, after somewhat worse results in 1980.

Besides the normal maintenance programme the work done during this year's long shutdown centred around the installations and modifications required for the extraction and transport of low energy antiprotons to LEAR. Placing an extraction septum magnet in straight-section 26 and a fast kicker in s-s 28 required the rearrangement of 11 straight sections and the exchange of two magnet units. On this occasion the last bending magnet of the 50 MeV transport line (for direct injection from either Linac into the PS) was overhauled and equipped with new coils after 22 years of service. The planned replacement of the delicate ceramic vacuum chambers with corrugated stainless steel components at fifteen locations began, and three units were installed. A pair of special quadrupoles, for adjustment of the momentum compaction factor during extraction of antiprotons for SPS, was installed (s-s 48 and 64). Seven defective poleface windings were replaced.

Various technical improvements were made in the equipment concerned with transfer of antiprotons. Fabrication began of a new design of the septum magnet, in straight-section 85, used in the process of slow extraction for the beam supplying East Hall experiments; this job is urgent in view of the known weaknesses of the present design.
Various further items were converted to the new computer control system. These included injection and extraction equipment in straight-section 26, low energy corrections and the CODD (closed orbit digital display). With this last device it is now possible to make ten measurements per cycle on both radial and vertical axes, whereas before only a single measurement in one direction could be made.

2.4 Controls

This period saw the implementation of the second major package in the controls conversion programme, covering a substantial proportion of the processes involved in running the main proton synchrotron. The first instalment, namely the transfer and matching between Booster and PS, was inaugurated already in September 1981, and the long shutdown at the beginning of 1982 was used to switch over the entire low energy correction system and essential instrumentation for beam measurements. The start-up via the new main operator consoles proved surprisingly smooth, rewarding more than a year of meticulous preparation by the parties responsible for the three aspects of the conversion: namely, the controls themselves, the process equipment and operation. The PS continued to function normally, and no additional stops were required. The overall loss of beam time due to the new system remained around 1%, with a small upsurge at the end of 1981 due to the addition of new features to the Booster controls.

The process of integration of the Antiproton Accumulator controls continues. Preparations are being made for the next instalment of the conversion programme, which will comprise extraction and beam transfer equipment. Work has begun on controls for the LEP preinjector project.

2.5 Performance developments in the PS

Several sessions at the end of 1981 and in early 1982 have been devoted to supplying the SPS and ISR with antiprotons, and the steady improvement of the techniques involved has enabled these machines to observe pp collisions at luminosities as high as $10^{27}$ cm$^{-2}$ s$^{-1}$.

Since the AA target can accept intensities at least as high as $2 \times 10^{13}$ protons per pulse, steps are being taken to push up the number of protons supplied in operation. Vertical addition at the Booster output should provide about $1.3 \times 10^{13}$ pp as a first stage, and as the programme for increasing Booster and PS intensities proceeds $1.5 \times 10^{13}$ pp could become available. A new scheme for transfer between Booster and PS, at present under study, could provide intensities as high as $2 \times 10^{13}$ pp for antiproton production.

A very important problem being studied concerns the conservation of transverse emittance values of the antiproton beam during its transfer, via the PS (where it is accelerated), from the AA to the SPS. This is essential in order to obtain the best possible luminosity for the colliding
beams in the SPS. To help in this work new instrumentation is being installed for beam profile measurements: a fast scanning wire in the PS and SEM (secondary emission) grids capable of working with low intensity beams in the AA - PS transfer line.

Studies continue on the radial instability which develops in the 10 GeV/c beam destined for the SPS after capture by the 200 MHz r.f. This phenomenon compels capture efficiency to be limited to 60%, so there is considerable interest in its suppression. With an increase in the 200 MHz r.f. voltage, this should result in the provision of a really well-bunched high intensity beam for the SPS.

The beam for LEAR will require deceleration of antiprotons from 3.5 to 0.6 GeV/c. Tests have permitted the appropriate cycles to be established for both main and auxiliary magnets (low energy corrections) and beam control to be adjusted. A first trial with antiprotons resulted in the deceleration of a beam of $1.6 \times 10^9$ particles down to 0.64 GeV/c without any deterioration of transverse emittance.

2.6 Antiproton Accumulator

The AA ring has been completely enclosed in concrete shielding to keep general radiation levels as low as possible for the 4000 hours of running time anticipated in 1982. During the long shutdown the opportunity was taken to carry out various improvements, in particular removal of aperture restrictions, modification of kicker and shutter mechanisms to get a better long-term reliability and the installation of baffles to stop the vacuum pumps from coupling the stack and stack-tail cooling systems by acting as resonators. Since only half the ring could be let up to atmospheric pressure, removal of other aperture restrictions will have to await the next long shutdown. Jacks were fitted to some quadrupoles so that orbit bumps can be generated to investigate the aperture.

Three weeks following the shutdown were used for machine experiments to some effect. A proton stack of more than $10^{12}$ particles - the biggest yet - was cooled to a longitudinal density slightly higher than the design figure for antiprotons; although transverse instabilities could be observed, the feedback systems coped adequately, and intra-beam scattering was much as expected. Another innovation was the use of the stack-tail kickers as a 270 MHz r.f. system to take small but frequent bursts of antiprotons from the stack (for LEAR). The experimental studies confirmed that improvements in all the cooling systems would be required to cope with a higher accumulation rate, and a programme to achieve this has been embarked upon. In addition plans have been made for a better geometry for the production target and focusing horn. Further ideas are being studied for incorporation into a long-term development programme.
2.7 LEAR

Magnetic measurements have been carried out on the dipoles, previously installed in their final position, and on the quadrupoles, and fields have been equalized and optimized by appropriate shimming. Vacuum chambers are being installed in the larger elements after laboratory tests. All items of beam transport between PS and LEAR are in place; cabling and plumbing have been done. Septum magnets and kickers for the ring are on test; correcting elements and units of instrumentation are being tested and installed as they arrive. The controls system will be in a sufficiently advanced stage for first operation around the middle of the year.

2.8 The PS as LEP preinjector

The LEP preinjector project comprises two linear accelerators and an electron–positron accumulator (EPA). For the design, construction and running-in of the linacs a collaboration has been established between CERN and the Laboratoire de l'Accélérateur Linéaire d'Orsay; a formal agreement was signed in March, although joint work had already been going on for some time. The front end of the high current linac has already produced 5–10 ns pulses at peak currents of 5 A and energies up to 28 MeV. A pre-prototype modulator is working, and a prototype accelerating structure will be ready for tests in summer. Studies of the optics of the 600 MeV linac are sufficiently advanced to begin design of quadrupole lenses and solenoids.

Design of the EPA is still evolving. Definition of parameters is closely linked to beam transfer possibilities in the EPA–PS–SPS–LEP chain. The charge per bunch which can be transferred with stable conditions is limited. The EPA is being designed as an eight-bunch machine, which, taking into account plausible kicker rise-times, leads to a circumference one-fifth that of the PS. Lattice design is progressing, and other main parameters will be settled in the course of the year. In the meantime, detailed design of the building to house the three machines is going on in preparation for tendering.

B. SYNCHRO-CYCLOTRON

The SC started up again with protons in December after a shutdown to service the rotating capacitor (Rotco). Normal beam intensities were quickly obtained and the machine ran reliably until the end of February. Some apprehension was caused by unusually high oil and water leaks on two of the Rotco's rotating seals. Meanwhile the second Rotco was on the test stand where work continued to prepare the r.f. system for operation at the relatively low frequencies required for neon
ion acceleration. This programme suffered serious setbacks in January and February with further spark damage to the disk capacitor gap (see Annual Report for 1981), and it became clear that high power tests would not be finished in time to offer experimenters the expected $^{20}\text{Ne}^{5+}$ beam in March. However, tests at the slightly higher frequencies of $^{20}\text{Ne}^{6+}$ acceleration were successfully concluded, and so the planned conversion of the SC to the ion acceleration mode went ahead as scheduled. A beam of $^{20}\text{Ne}^{6+}$ of good intensity was extracted from the machine with very little trouble, but unfortunately the Rotco developed the sparking problems that had become all too familiar during the months of testing. It was decided, with the approval of the users, to abandon neon for the time being and to revert to the standard "carbon" ion beams, on the principle that "a bird in the hand is worth two in the bush". A detailed investigation of the sparking problem was immediately undertaken.

The "carbon" period was once again very successful, a new feature being the production of beams of $^{18}\text{O}^{6+}$ ions of 84 MeV/nucleon, at intensities of nearly $10^{11}$ ions/second, as some compensation for the loss of the neon ion beams. This period ended early in May, and the SC was converted back to proton acceleration. Advantage was taken of the relatively low levels of radioactivity to do several maintenance jobs. However, the Rotco was not serviced, since the rotating seals had reached a stable leakage rate which was high but not unacceptable. June will see the return of ISOLDE, following the repair of its separator and the installation of an industrial robot for target changes.
1. **ISR OPERATION**

The start-up on 25 February, after the usual winter shutdown, went very smoothly and was followed by several physics runs at 31 GeV. The luminosity achieved was fairly high on some of the runs, whilst on others a lower luminosity had to be accepted due to machine problems, in particular with the r.f. cavities. Some of the beams for physics were lost and the technical reasons are known; for example, the breakdown of the compressor of the cryogenic installation for R110.

On 15 March, a programme was started with the object of obtaining colliding proton-antiproton beams at 31 GeV for experiments R210/211. Several attempts were needed to reach this goal because the antiproton filling failed several times or was perturbed by such causes as a short-circuit in a magnet, an electrical power cut of the CERN site, a water interlock in the AA, etc. A successful 3.8 mA antiproton stack at 31.4 GeV was finally achieved on 6 April, resulting in a five-day long run ending on the Easter week-end. An initial luminosity of $1.0 \times 10^{27}$ cm$^{-2}$ s$^{-1}$ was increased during the first day to $1.2 \times 10^{27}$ cm$^{-2}$ s$^{-1}$ due to the application of stochastic beam cooling.

After the Easter week-end, the machine was set up for a physics programme at 22 GeV. Some problems were again caused by an electrical power cut whilst it became evident that operation at 22 GeV with the present magnetic machine configuration is limited to beam currents of about 30 A in each ring due to beam-beam forces. In a further successful machine development run with the two low-beta insertions in intersections 1 and 8 switched on, a luminosity of $10^{32}$ cm$^{-2}$ s$^{-1}$ was reached.

By the end of April, the machine had achieved 904 hours of operation; 451 hours at 31 GeV and 162 hours at 22 GeV with protons, 182 hours at 31 GeV with antiprotons. The rest of the time was used for starting up and machine development. A fairly large amount of scheduled machine time was lost due to the problems referred to above, particularly during the antiproton period.

2. **SUPPORT FOR THE ISR PHYSICS PROGRAMME**

During the first half of this year, the ISR Division provided support for ten running experiments, the equipment of one completed experiment was removed and preparations were made for two new experiments.

General maintenance, repairs or modifications were carried out on the detectors and infrastructure of experiments in five intersection regions during the annual winter shutdown. A major overhaul was made of the compressor for the cryogenics of experiment R110, but in spite of this the crank shaft broke after only a few weeks of operation. Efforts to operate the superconduc-
ting solenoid using liquid helium from elsewhere at CERN were not successful, but a rapid repair of the severely damaged compressor allowed normal operation after Easter.

Only small interventions, for example to check alignment or add small detectors, were necessary in intersections 1, 2 and 4, but in intersection 6 a large forward shower counter was installed for the first time for experiment R608 and the 90° spectrometer of the same experiment was completed, all supporting structures and cabling having been supplied by the Division. In intersection 8, the liquid argon calorimeters of experiment R806 were removed, after seven years at the ISR, to be replaced by the third side of the uranium calorimeter of experiment R807. This experiment also added a completely new forward detector system downstream of the superconducting quadrupoles of the high-luminosity insertion. The vacuum chamber in this region was replaced to allow the drift chambers to detect charged particles passing through the quadrupoles. The modifications and subsequent vacuum bake-out were carried out in parallel with the rest of the major work in this intersection area. Finally, a fine grain calorimeter comprising 600 sodium iodide crystals was installed in front of the uranium calorimeter for the new experiment R808. Preparations are now in progress for the installation of the final calorimeter of experiment R807 and the second crystal wall of experiment R808 during the July-August shutdown, again a major intervention.

A considerable effort has been put into preparations for experiment R704 which will use a hydrogen-jet target and a 4 GeV antiproton circulating beam to study charm states. Laboratory testing of the target started at CERN at the end of 1981, but difficulties in the fabrication of the 30 m nozzle needed to produce the dense hydrogen-jet meant that it was not possible to install it in the ISR in February as foreseen. Testing has continued, in particular all the control systems for the remote operation in the ISR have been fully commissioned and in the meantime the firm responsible has solved the nozzle fabrication difficulties. It is now hoped to complete testing and reach design performance in time for installation in July. Studies for the production and control of the low-energy antiproton beam including a momentum cooling system have also started.

The experiment uses a double-arm spectrometer to detect photons and charged particles and construction of the detectors is well advanced. All the mechanical structures have been designed in the ISR Division and are now being manufactured by outside firms. A comprehensive test rig to allow the calibration of a complete spectrometer arm in an electron test beam has also been designed and is under construction. Preparations in the ISR itself included a vacuum intervention in the winter shutdown, installation of cables, cryogenic and gas lines and modifications in the gas barrack and counting room.
The SPS resumed operation for fixed-target physics at the end of February, after the usual winter shutdown. The start-up of the accelerator was perturbed by eight interruptions of 18 hours each, imposed by reductions in the available electrical power during the so-called "critical days" stipulated in the new EDF contract concluded last year. The average efficiency of the operation of the SPS during period 1 was 78%.

As part of the continuing effort to improve the accelerated beam intensity, successful tests with beam have been made of a new feedback system which reduces the apparent impedance of the travelling wave accelerating cavities experienced by the beam.

The delivery and installation of the new transformers for the main power supplies in preparation of the operation of the SPS at 450 GeV is progressing on schedule.

A great effort has been made to analyse the experience gained during the first period of operation of the SPS as a proton-antiproton collider at the end of last year and a programme of pp consolidation is being implemented. Among this work should be mentioned the improvements of the reliability of the r.f. system, of the stability of the main rectifiers and the low-beta power supplies and of the quality of the vacuum in the colliding-beam regions.

In the North Area, two new septum magnets have been installed in the front end of the H6 beam and gave a tenfold increase of flux at -175 GeV/c for NA11. A new silicon crystal used as photon converter in the beam E12 gave a 12% increase of flux. A better focusing of the M2 beam on the NA9 target has improved the production rate by 20%. Preliminary studies were made for the implementation of a new K0/L0 beam in EHN1.

The new computer network in the North Experimental Area is now fully operational and gives a much better service to the many users. Line surveyor modules have been commissioned to record faults and speed up the diagnostics, so that the maintenance of the electronic equipment in the whole area has become more efficient.
For the West Area, the detailed preparation and planning of the upgrading to 450 GeV is ready.

Good progress is being made in the completion of the PO-prototype magnet: the superconducting coils are being wound and impregnated, subsequent to the completion of a coil pair made of dummy conductor.

Six hydrogen targets have been in operation and five new targets for liquid or pressurized hydrogen are being manufactured.

A new 18 MVAR compensator was put into operation as part of the project for increasing the SPS energy to 450 GeV.

During this period, all air treatment plants of the SPS ring tunnel were completely overhauled.

The studies for the adaptation of the SPS as an injector for LEP are progressing. A prototype standing-wave cavity for the acceleration of electrons and positrons in the SPS has been installed in LS83. Tests concerning its response to the intense proton beam during fixed-target operation have started. In particular, the potentially dangerous higher order modes of the cavity are being investigated.

Several SPS Groups are deeply involved in the design studies for LEP itself. Major activities in this respect are the electrical distribution system, the computer control system, the survey and the installation and mechanical infrastructure for the Main Ring of LEP.
1. **ETUDES, TRAVAUX NEUFS ET MODIFICATIONS**

1.1 Au cours du premier semestre 1982, les travaux suivants ont été mis à l'étude, en chantier ou réalisés.

1.1.1 **LEP**

- Les études concernant le tunnel et les zones d'expérimentation dans la plaine ont été poursuivies. L'appel d'offres des trois lots de travaux de ces mêmes ouvrages a été établi et lancé.

- Les travaux de la galerie de reconnaissance ont été repris et se poursuivent normalement.

- Les sondages permettant de déterminer avec précision le niveau du toit de la molasse sur le pourtour du tracé du tunnel ont été poursuivis.

- La réalisation de l'étude d'impact a nécessité l'exécution de nombreuses maquettes, photo-montages, films magnétoscope, etc.

- Les plans d'avant-projet du préinjecteur ont été établis.

1.1.2 **Site de Meyrin**

- Mise à la disposition des utilisateurs des ouvrages pour la décharge de faisceau 80.

- Mise en chantier du Foyer Visiteurs.

- Appel d'offres et mise en chantier des travaux concernant l'expérience des oscillations des neutrons, comportant des galeries souterraines et à ciel ouvert ainsi qu'une fosse dans le hall 181 des ISR.

- Études, constructions ou transformations pour les zones d'expérimentation et leurs annexes (déplacement expérience Oméga, etc.).
1.1.3 Site de Précessin

- Mise à la disposition des utilisateurs du bâtiment pour cibles hydrogène.
- Construction d'une zone de stockage pour hydrogène.

1.2 A l'exception du LEP, tous ces travaux comprennent non seulement le génie civil, mais aussi souvent les installations techniques associées: ventilation, chauffage, mécanique, ponts roulants, ascenseurs, électricité, téléphone, systèmes de refroidissement et installations de pompage. En six mois, le total des commandes pour ces installations techniques s'est élevé à 7 millions de francs suisses.

1.3 Les travaux de modification correspondant aux installations d'expériences et aux améliorations des conditions de sécurité ont sensiblement diminué en importance financière par suite des compressions budgétaires; néanmoins, environ 750 interventions de petits travaux ont été réalisées, dont 50% par les ateliers de la Division. Certaines modifications plus importantes ont été effectuées, comme les travaux préparatoires pour la zone du préinjecteur du LEP, la fin des travaux dans la nouvelle zone de stockage de gaz, ainsi que le début des études pour la transformation de la zone Ouest du site de Meyrin pour la physique à 450 GeV.

2. ENTRETIEN ET EXPLOITATION

2.1 L'activité d'entretien s'est déroulée selon les programmes établis dans les différents corps de métier:

- 5000 dépannages environ ont été effectués sur les différentes installations.
- Quelque 250 manœuvres et 130 essais de câbles ont été réalisés sur le réseau HT/BT.
- Près de 50 Notes de coupure ont été diffusées et les manœuvres consécutives réalisées dans les différents réseaux de fluides.

2.2 Parmi les travaux de modification ou d'entretien spéciaux, on peut citer:

- Modification des stations de pompage 3 et 4 et mise en service de deux pompes à vitesse variable.
- Amélioration de la production pour les réseaux d'air comprimé des deux sites.
- Déplacement et installation du groupe électrogène G7 au puits de la galerie de reconnaissance du LEP.
- Remplacement des 8 tableaux de régulation de la climatisation du PS.
- Modernisation de la climatisation d'ERASME.
- Installation du nouvel ordinateur Siemens au Centre de Calcul.
- Mise en service des surpresseurs d'eau de refroidissement en LSS4 et LSS5.

3. **ATELIERS CENTRAUX**

Si la charge de travail est moyenne dans son ensemble, on note cependant une nette reprise dans les sections où se réalisent des travaux spéciaux tels que des prototypes pour les projets LEAR, pp et LEP ou pour les expériences de physique.

3.1 **Projet LEAR**

Réalisation de tanks à vide et de chambres à vide en acier inoxydable, de section rectangulaire, ayant un rayon moyen de 4061 mm et sur lesquels sont soudés, par procédé TIG manuel, divers piquages.

Fabrication et soudage de pièces de transition sur membranes hydroformées. Plusieurs miroirs plans, paraboliques et sphériques, ainsi que des imprégnations sous vide de bobinages, des guides-lumière, des grilles pour mesures des faisceaux ont été réalisés par le Groupe. Dépôts d'argent sur passages étanches en titane.

3.2 **Projet pp**

Fabrication de prototypes et d'ensembles à deux âmes flexibles et corne magnétique en alliage d'aluminium.

3.3 **Projet LEP**

Usinage, traitements thermiques, brasages sous vide et montage de deux prototypes de dispositif d'accord à piston. Des cavités accélétratrices et des coupleurs de puissance ont demandé beaucoup d'efforts et de soins lors des usinages, traitements thermiques et de surface, ainsi que des contrôles dimensionnels et métallurgiques. Pour la réalisation des cavités
supraconductrices en niobium 500 MHz, un nouveau mode d'élabo-
ration a été essayé avec succès: il s'agit du formage sous
60 bars de pression d'une zone équatoriale qui, après soudage
sur 2 calottes sphériques obtenues par repoussage, permet de
positionner les coupleurs hors de toute zone de soudure (un
prototype est en cours pour DESY). Les essais de polissage
chimique du niobium ont été poursuivis; un rapport sur l'étude
et les moyens d'analyse des bains a été publié.

3.4 Rotco

Diverses pièces (conducteur externe, cône souple, rotor)
on ont été élaborées ou traitées et ont nécessité l'intervention de
nos mécaniciens-monteurs.

3.5 Machine SPS

Réalisation de cavités en cuivre sur lesquelles des traite-
tements de surface (polissage mécanique), des traitements ther-
miques et des contrôles dimensionnels ont été effectués. Fabri-
cation d'un prototype de 1 mètre de long pour cryostat supra-
conducteur. Cet ensemble est constitué d'un tube interne en
acier inoxydable (épaisseur: 1 mm) sur lequel sont rapportées
des tôles intercalaires usinées par photogravure et servant
à la circulation d'hélium liquide. Ce premier élément est
fretté dans un tube externe, également en acier inoxydable,
de 2 mm d'épaisseur. Le cryostat définitif aura 6 mètres de
long. Pour le linac, des opérations de polissage mécanique et
des revêtements de cuivre "spécial r.f." ont été effectués
sur des lames en acier pour structures R-F-Q. L'atelier des
résines synthétiques a réalisé des demi-culasses par imprégnation.

3.6 Expériences diverses

- Mise au point d'un dépôt d'or, pureté 99,99%, pour métal-
lisation de microcircuits.

- Réalisation de compteurs, hodoscopes, miroirs, traversées
étanches à la pression et à la lumière pour circuits impré-
més, moulages de connecteurs.

- Fabrication de circuits imprimés multicouches (6 couches)
de grand format (450 x 350 mm) pour Fastbus, de circuits
souples (1000 x 400 mm) pour le projet ASTERIX, de circuits
à couche épaisse (7 couches conductrices et isolantes) sur
substrats en céramique.

- Etudes et essais de pressage et d'usinage de sandwiches de
plomb/époxy pour maquette de calorimètre.
3.7 Développements et améliorations des équipements du Groupe

- Construction d'une machine pour soudage interne à la torche plasma sous contrôle endoscopique des membranes souples et étude d'une seconde machine pour soudage externe.

- Etude et réalisation d'un plateau tournant de 1200 mm de diamètre pour la machine de soudage par faîsceau d'électrons.

- Mise en service d'une salle "propre" avec hottes à flux laminaire vertical, équipée pour l'application et l'insolation de photoresists destinés à des travaux de gravure de haute définition (de l'ordre de 10 microns).

- Étude de la réalisation par microélectroformage de buses d'injection gazeuse ayant un trou central de 10, et même 5 microns de diamètre.

3.8 Sous-traitance

L'activité, bien que moins soutenue qu'au cours du premier semestre de 1981, se redresse graduellement, notamment par suite des projets LEP et LEAR. On constate une reprise de la demande en circuits imprimés spéciaux.

4. TRANSPORTS, MANUTENTION, NETTOYAGE

Après l'arrêt simultané des machines pendant les deux premiers mois de l'année, l'activité a repris normalement dans l'ensemble des deux sites, où l'on peut relever les interventions suivantes: installation du projet LEAR, modifications et transformations de la zone Nord SPS, BA4 et BA5, installation de la décharge de faisceau 80.

Le parc de véhicules s'élève actuellement à 692 véhicules ou engins, en plus des 336 véromoteurs et 435 engins spécifiques à la Division SPS.

5. PERSONNEL

En conséquence de la politique des départs négociés, les effectifs de la Division SB continuent de diminuer, une partie seulement des nombreux départs ou transferts étant compensée par des recrutements externes. À la fin du premier semestre, les effectifs de la Division s'élèveront à 520 personnes, en diminution de 100 personnes par rapport au maximum atteint en 1974, et cela malgré une augmentation importante des charges d'entretien et d'exploitation des sites.
III. THE LEP PROJECT
THE LEP PROJECT

The withdrawal, during the December session of Council, of the last reservations of some Member States on the approval of the LEP project, and the decision taken just before the end of the year on the final position of the LEP ring, set the scene for the start of the execution of the project at the very beginning of 1982.

Thus the machine layout was finalized, the tender documents for the civil engineering work in the plain were prepared and the call for tenders was dispatched at the end of March.

At the same time, the call for tenders for the 3400 steel-concrete cores for the LEP dipole magnets and the one for the 16 klystrons of 1 MW continuous power rating for the LEP acceleration system were dispatched. The contract was placed for the purchase of a two-laser terrameter, the only instrument capable of achieving a measuring accuracy of 10^{-7} on the scale of the LEP machine in an efficient way. Orders for prototype klystrons of 35 MW pulse rating for the e^+ e^- linacs were placed at the end of April.

The environmental impact study was adapted to the new location and discussed with the French authorities. By mid March the amended version was submitted to the French Foreign Ministry for final comments.

The Project Leader has set up the project management structure and the project team is being completed by staff from several Divisions. Arrangements are being made so as to ease the internal staff transfers which will be necessary to strengthen the groups working on the project.

Upon an order from the French Supreme Court (Conseil d'Etat), the boring of the reconnaissance gallery, halted last July by an Administrative Court, could continue on 1 February. In the frame of the new machine layout, this gallery will also serve as an access for builders of the main tunnel in the piedmont area, where full-face boring is not possible.

The general design of the LEP ring is being reviewed once more in order to settle any remaining issues in lattice design, chromaticity correction and low-beta insertions, so as to obtain optimum operating conditions.

Design and development work on all parts of the machine is continuing. The overall design of the pre-accelerator and injection system is being completed and tendering for the buildings to house the new electron and positron linacs and accumulator is imminent. The stability of the beam in the various machines against the known instability mechanisms has been investigated. The Convention with the Institut National de Physique Nucléaire et
Physique des Particules, IN2P3, and the Orsay Linear Accelerator Laboratory for the construction of the $e^\pm$ linacs as a joint venture was signed at the end of March.

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In the magnet area, in addition to pushing ahead the design of the many magnet types necessary, demonstrations of the production of steel-concrete cores have been organized for firms interested in tendering. The RF Group has received its second prototype 1 MW klystron, assembled horizontally as envisaged for installation in the tunnel. The Vacuum Group has continued investigations of getter pumps, both in the laboratory and in a prototype vacuum chamber exposed to synchrotron light at Orsay. Prototype lead shieldings have been soldered successfully to $3$ m long vacuum chambers.

Work on all other systems of the machine is progressing, adapting where necessary to the new machine location, with the aim to settle all final definitions before the end of the year.

The LEP Experiments Committee was set up and, at its first meeting, held a first discussion on the seven letters of intent so far received. The compatibility of the proposals with the design of the experimental caverns is being studied by the Experimental Support Group.

Finally, a great effort has been made to explain to the population of the Canton of Geneva and of the Pays de Gex the purpose of the LEP project and its impact, both during the time of construction and once finished. A series of three discussion sessions organized in conjunction with the Institut de la Vie took place in the University of Geneva. Exhibitions were held at Meyrin and Ferney-Voltaire, followed by popular presentations of the research aims of CERN and talks on some outstanding technical subjects. As a result it is hoped to improve the mutual understanding between CERN and the population of the surrounding areas and to allay the suspicions voiced by a few individuals regarding CERN's scientific approach and the fears of any long-term consequence of LEP on their health.
IV. ADMINISTRATION

- Documentation Department
- Finance Department
- Health and Safety Department
- Management Information
- Personnel Department
- CERN Staff Insurance Scheme
The newly-formed Documentation Department was organized into four Groups bringing together sections which had common interests and abilities.

The Composition and Imprimerie Group includes the Central Text Processing Section and the CERN Printshop. Text processing using the Nortext system developed by Norsk Data has been extended with the introduction of four new terminals. Steadily increasing volumes of work are passing through the Group, which can now ensure better presentation of documents like the "Yellow Report" series than was possible before and enable the printing inside CERN of quality documents (such as the Annual Report and four-colour documents presenting CERN's activities to visitors).

The Exhibition and Mail Office Group has had a very interesting and demanding programme of work in the preparation of exhibitions. These were organized at the Science Museum in Barcelona, Spain, and at the House of Scientific Societies in Helsinki, Finland. Both exhibitions attracted thousands of visitors, enabled many useful contacts to be made and helped to project the value of high-energy physics and of CERN. In the local region, a series of exhibitions and discussion evenings were organized at Meyrin, Ferney-Voltaire and St-Genis-Pouilly to present the LEP project to the host communities.

The Editorial Group participated in the preparation of the LEP project environmental study and, more extensively than usual, in the preparation of the Annual Report. The Translation and Minutes Section was faced with an increasing workload owing to the arrival of specifications and documentation for the LEP project. The number of meetings requiring the services of minute-writers remained at a high level, and both minutes and their translations had to be prepared in a shorter time than usual. Preparations were made for the operation of word-processors in the Section, linked to the Council Secretariat and to the Nortext system. The first terminal was brought into operation and the necessary staff training was given. The glossary available to the translators has been brought more up to date and supplemented by entries from the Section as a whole. The possibility of having the glossary entries accessible in a computer memory was studied.

The Scientific Information Service continued library operations at about the level of recent years. Preparations for the automation of many of these operations, via links to the Main Computer Centre, advanced but not as quickly as had been hoped. The extension of the CERN archives continued and the arrangements were made for the start of the CERN history project in October 1982.
1. SITUATION FINANCIERE

Les difficultés de trésorerie dont il a été rendu compte l'an dernier n'ont pu être éliminées en ce début d'année. Elles sont dues en partie au fait qu'un solde important des contributions de 1981, soit 37,47 millions de francs suisses, n'avait pas encore été réglé à la fin du précédent exercice et qu'il a contribué à alourdir une situation déjà difficile car les provisions, à la fin de 1981, étaient inférieures à celles des années précédentes.

Certaines contributions importantes de l'année 1982 sont, en outre, arrivées tardivement, à la mi-mars, entraînant des difficultés supplémentaires.

Quant aux prévisions de recettes d'intérêts bancaires pour 1982, il n'est pas évident, à la fin d'avril, qu'elles atteindront les 11 millions de francs suisses prévus au budget, compte tenu de la très importante réduction des taux d'intérêt servis par le marché suisse.

2. SERVICES FINANCIER ET COMPTABLES

Un nouveau système de facturation automatique se met progressivement en place à la Comptabilité des débiteurs. On espère le rendre complètement opérationnel au cours de 1982.

Le personnel fait l'objet d'un entraînement intense à l'utilisation des terminaux et on compte pouvoir, en 1982, employer ceux-ci pour les introductions des données.

La Comptabilité du personnel a mis en application le nouvel indice des traitements et des allocations familiales ainsi que les nouvelles cotisations à la Caisse d'Assurances, décidés par le Conseil en décembre 1981 et arrêtés par le Comité des Finances en février 1982.

3. SERVICE DES ACHATS

L'informatisation du Service des Achats est en cours. Le progiciel d'IBM, COPICS-Achats, introduit sur le marché en mai 1981 et déjà utilisé dans l'industrie, a été loué. Il est maintenant installé et les premiers essais ont montré qu'il permet d'exécuter la plus grande partie des tâches nécessaires à une gestion automatisée des achats; toutefois, ce produit doit être adapté aux besoins du CERN.
La première étape consiste à élaborer un fichier contenant tous les fournisseurs potentiels du CERN et à permettre leur recherche en fonction du type d'activité exercée.

4. SERVICE DES MAGASINS

Le nouveau Magasin Gaz a été mis progressivement en service depuis le début de l'année.

La documentation générale (catalogues, etc.) des fournisseurs de l'Organisation a été intégrée dans le Service d'Information Technique.
HEALTH AND SAFETY DEPARTMENT

1. MEDICAL SERVICE

During the first half-year of 1982, the Medical Service was faced with the necessity for a strict determination of its priorities. Amongst those activities which could be coped with were the clinical personnel monitoring (about 1000 examinations during the first six months), the conclusion of the systematic examination of the entire staff of the ISR Division, and the start of such an examination in the SPS Division. Haematological examinations continued at a similar rhythm to last year (about 2500 examinations in six months). 350 persons have been invited for biological examinations.

Visits to work areas continued at a rate of 20 per month. More than 40 new first-aiders were trained in the first four months.

2. GENERAL SAFETY GROUP

To promote greater flexibility, the Emergency and Fire Service was attached to the General Safety Group from 1 January 1982. This change in structure should contribute to the maintenance of an acceptable level of safety in the increasingly complex environment of the Laboratory.

In the field of accident prevention, due attention was given to studying those parts of projects which present a hazard, and regular inspections of installations and premises were carried out to ensure the respect of safety rules, and to prevent pollution of our environment.

The Emergency and Fire Service continued to exercise its function as the strong arm of safety, as witness the figures of the last six months. It intervened 330 times to attend to fires, floods, gas leaks, broken down lifts, and false alarms. The ambulances carried out 165 trips to transport wounded and sick persons, in 73 cases outside the CERN sites. Furthermore, the firemen transported some 1400 persons between the Meyrin and Prévoisin sites or to the Hostel in St Genis, and delivered over 3700 passes to visitors and newcomers.

3. RADIATION PROTECTION GROUP

During the long shutdown of the PS, ISR, and SPS at the beginning of the year, the Radiation Protection Group was involved in work planning and surveillance in radioactive accelerator areas and in handling and transport of active components.

Radiation Protection tasks at the accelerators and experimental facilities continued to increase with new areas, beam dump facilities, and new projects; in particular, the modification of the West Experimental Area, the construction of the new oscillating neutrino facility, LEAR, the AA improvement programme, and studies for a new TOSHK area.
Dose rates due to Antiproton Accumulator operation were considerably reduced as a result of the completion of the shielding around the AA ring.

About 20% of the activities of the Group were devoted to the LEP project. Among these were: the continuation of calculations and estimations of radiation parameters by the LEP Radiation Working Group; the selection and testing of radiation-resistant materials to be used in the LEP synchrotron radiation field; the specification of LEP monitor systems by the Technical Support Section.

Other activities included: specifications for the shielding of the e⁺Linac and Accumulator and their ventilation systems which are nearing completion; further development of the Monte Carlo Cascade Codes in collaboration with the Helsinki University of Technology and the University of Leipzig. The Personnel Monitoring Section devoted a considerable effort to the improvement of the presently used hadron detector (NTA film), and of the data handling possibilities.

Additional efforts were devoted to improving and modifying existing measuring systems, in particular, the SPS beam-loss system, the Rover dose-measuring vehicle, modifications of the West Area monitors, installation of the monitors for the beam dump facility, preparation of the monitors for the neutrino oscillation experiment, and the SC monitor system.

4. CENTRAL SERVICES

Concurrent with the transition of HS from a Division to a Department of the Administration, the Telex and Telephone Exchange operations were transferred to the Group from Personnel Department. The unit's activities remain unchanged.

The remainder of the Central Services has continued to pursue its wide spectrum of activities. These range from security (traffic control, etc.) to technical, documentary, and administrative support to other units.

The activities of the Radiobiological Research Group were discontinued.
INFORMATION DE GESTION

1. GROUPE PREVISIONS ET STATISTIQUES

Ce Groupe a collaboré à la préparation et à l'édition du document "Activités scientifiques et prévisions budgétaires 1983-1986". Il a également préparé l'édition finale du budget 1982 en collaboration avec le Département des Finances. Il a, par ailleurs, mis en place un nouveau système de rapport mensuel de gestion à la Direction (Tableau de bord). Le Groupe a fourni, sur leur demande, des informations aux services de statistiques des institutions des Etats-hôtes ou d'organismes internationaux. Parallèlement à l'ensemble de ces travaux, le suivi de l'utilisation des ressources de l'Organisation (par activités de recherche, par projets, coûts et effectifs de personnel) a été assuré en s'appuyant sur le PBS (Planning Budgeting System) en liaison avec les autres Divisions/Départements.

2. GROUPE TRAITEMENT DES DONNEES

Ce Groupe a continué le développement de l'informatisation du traitement des données administratives, tout en assurant le fonctionnement des systèmes existants. Il a notamment installé un nouveau système de gestion destiné au Service des Achats et a poursuivi l'installation des terminaux destinés aux utilisateurs ainsi que la formation de ces derniers. Le Groupe a installé un générateur de rapports qui, dans le contexte du système d'exploitation "VM", doit permettre une prise en main progressive et à long terme de leurs applications par les utilisateurs eux-mêmes. Un effort important est par ailleurs consacré à l'achèvement de la conversion aux nouveaux systèmes d'exploitation et à la mise en place d'un système interactif d'introduction des données. Il a enfin entrepris la conception des bases de données financières et du personnel dans le nouveau contexte de matériel et de logiciel.

3. GROUPE TACHES SPECIALES ET PROCEDURES

Ce Groupe a préparé la rationalisation et le regroupement en un seul système du suivi de l'appui industriel. Il a entrepris la conception d'un système de planification de l'emploi qui puisse mieux répondre aux besoins de l'Organisation dans le cadre des contraintes qui lui sont fixées pendant la période de construction du LEP. Il a entrepris également la préparation d'une proposition pour une nouvelle méthode de calcul de l'indice de variation des coûts du matériel. Le Groupe procède enfin à une analyse systématique des procédures administratives liées en particulier à l'informatique ainsi que des divers formulaires existant dans l'Organisation pour rechercher des simplifications et des rationalisations. La coordination des budgets et des locaux est assurée au niveau de la Direction de l'Administration par deux membres de ce Groupe.
Personnel Department staff have contributed in a number of spheres to the work of the Standing Advisory Committee, where the subjects discussed during the first part of 1982 included:

- Implementation of CERN Staff Policy:
  Work by the group nominated by the Director-General continues.

- Job and Salary Comparisons:
  The final report of the study group was discussed by the Committee.

- CERN Suggestion Award Scheme:
  An award scheme was approved for a trial period of one year.

- Internal Staff Mobility:
  A new procedure was introduced on a trial basis to help to increase internal mobility, particularly in view of the requirements of the LEP programme.

- Training and Education:
  The proposed Administrative Circular on Staff Training was discussed by the Committee.

- Social Security:
  A cross-referenced summary of the social security measures applied in CERN and covering staff members was prepared.

The number of unpaid associates increased again, at an annual rate of 10%; those from Member States now total over 2000. The number of fellows and associates paid by CERN also increased slightly.

Lors de l'examen du personnel et des postes de 1982, 284 postes ont fait l'objet d'un examen par le Département du Personnel. Sur les 55 cas de recours en classification et non-promotion examinés par la Commission de Recours: 14 cas ont été promus au 1er juillet 1981 (dont 4 avec reclassification du poste); 7 cas ont vu leur classification modifiée au 1er juillet 1981.
The Department has continued to participate in the Organization's discussions on residence and work permits with the Host State authorities. This has stimulated an additional social case load of approximately 310 applications from individual expatriate families from a total of more than 500 personal enquiries of varying types.

The installation and equipment of the classrooms for the Education and Training Services in the former ESO barracks was completed.

The construction of the Hostel extension, which began in October 1981, is progressing according to the foreseen timetable, and it should be available for occupation by the beginning of 1983. A call for tenders for the furniture and equipment has been prepared, and the contracts should be passed in the summer. With the support of the Advisory Committee of CERN Users, the plans have been modified to include a shower in each bedroom, and a terrace which will be created on the roof of the four-storey building.

Le 1er janvier 1982, le Département s'est vu confier la responsabilité du remboursement de tous les impôts (américains, britanniques, français, suisses, etc.) prélevés sur les traitements du CERN.
The Management of the Staff Insurance Scheme has undertaken the preparatory work, including several meetings of the Management Board of the Scheme, for the application of the scheme of complementary pensions and allowances for beneficiaries, approved by the Council in December 1981. Other work has included the closure of the 1981 accounts, preparation of the Annual Report of the Scheme, the elections, the ever-increasing investment portfolio, the determination and payment of benefits as these fall due, examination and settlement of accident claims and participation in numerous working and study groups concerned with various aspects of the social security of CERN staff and their families.
V. DIRECTOR-GENERAL

- Office and Services of the Director-General
OFFICE AND SERVICES OF THE DIRECTOR-GENERAL

A new public relations policy was already initiated last year and the efforts devoted to this work were considerably intensified in the first months of 1982. A series of public debates on LEP and its consequences were organized at the University of Geneva together with the Institut de la Vie and attracted a large audience. In order to give the local population, particularly that of the nearby communes and villages, as much information as possible about CERN and about LEP, an exhibition describing the LEP project was mounted first at Meyrin and subsequently at Ferney-Voltaire, and was accompanied by lectures and open debates on various aspects of LEP. (Further details are given in the report of the Documentation Department.) In connection with these activities, the Press and Visits Service established closer links with the local media and organized a large number of visits of the Laboratory both for individuals such as the Spanish Minister for Industry and Energy and for groups from schools and clubs as well as groups of industrialists, parliamentary groups from Spain and Sweden and the Science and Engineering Research Council of the United Kingdom.

The Service for Relations with the Host States had numerous contacts with the French and Swiss authorities in connection with the events mentioned above as part of the campaign to spread information about the LEP project as widely as possible. Its major activities so far this year concerned the preparation and submission to the French authorities of documentation mostly concerning the impact of LEP on the local area (the "Etude d'Impact"), prior to the "Déclaration d'Utilité Publique" (DUP) for LEP, as well as the preparation of a complementary dossier for the Geneva Department of Public Works relating to the construction work for LEP which will be carried out in Switzerland. The Service also took part in negotiations with the labour authorities of the two Host States leading to improvement of the situation of firms working at CERN, and took part in information meetings with representatives of the employers and of the trade unions, which led to clarification of the situation of personnel working on the CERN site.

The other Services, namely the Council Secretariat, the Internal Audit, the Legal Service and the Scientific Conference Secretariat, continued with their normal activities; the Legal Service was particularly concerned with the preparation of documents required for the LEP project as well as with the legal aspects of the request made by Spain to rejoin the Organization.