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RAPPORTS D'ACTIVITÉS PRÉSENTÉS AU CONSEIL

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I RESEARCH DIVISIONS

- Theoretical Physics Division (TH)
- Particle Physics Experiments Division (PPE)
- Electronics and Computing for Physics Division (ECP)
- Computing and Networks Division (CN)

THEORETICAL PHYSICS DIVISION (TH)

The May 1994 telephone list of CERN-TH Division had about 140 names. During the first four months of 1993, 120 preprints were registered.

As in previous years, the activities of the Theory Division (TH) covered virtually all fields of high-energy physics and related areas. We represent a rather large community of physicists, and it is natural to expect that the production of TH should give a faithful portrait of the topics of interest in the high-energy community world-wide.

The main body of the research centres on phenomenological aspects of the Standard Model and some of its most plausible extensions. These topics account for 70 publications, or about 58% of the total. More theoretical topics accounted for 40 publications or 34% of the number of preprints. Some 11% of the preprints discussed problems of the boundary of particle physics with astrophysics and cosmology. Finally, the remaining 3% of the papers were on topics in field theory related to condensed matter theory.

The research on phenomenology was remarkably varied. A number of papers were directly inspired by the LEP experiments, also including the prospects for LEP2. On more general grounds, there were papers on all subjects of current interest, e.g., QCD, both perturbative and non-perturbative, and CP violation, extensions of the Standard Model, especially supersymmetry and the study of the electroweak phase transition. The subject of b decays has received particular attention. The simultaneous presence at the TH Division of several leading experts in the subject has led to many interesting results and to an active interaction with the experimental groups.

On more theoretical subjects there have been studies on quantum field theory, especially conformal field theories, superstrings and supersymmetry. On matters related to astrophysics and cosmology, topics that were discussed are related to cosmic strings, inflation, black holes and dark matter.

Two particularly interesting and successful short workshops has been held. The first, from 14 to 18 February, was on Ion Collision Physics, organized by H. Satz. The second from 10 to 11 May, was on Collisions at Planckian Energies, chaired by G. Veneziano.

PARTICLE PHYSICS EXPERIMENTS DIVISION (PPE)

LEP EXPERIMENTS

The past six months have been extremely productive for the four LEP experiments as can be judged from the number of physics papers published (around 10 per experiment) and the 7 to 15 PhDs obtained in each of the collaborations during this period. A prerequisite for such productivity is the efficient operation of the extremely sophisticated LEP detectors. This in turn requires extensive and regular maintenance. The shut-down period from November 1993 to mid April 1994 was used to carry out such maintenance and a few major repairs on the detectors. Some new components were added and others upgraded to improve performance with the 8-bunch operation of LEP 1 or for the future operation of LEP 2. All four experiments managed to finish their heavy work load on schedule.

ALEPH

During the warm-up of the solenoid, a strong leak developed in the helium screen. After careful tests and inspection through one of the chimneys, the defect was found to be just reachable by machining a large opening into the thick end flange. The operation was successful and the leak repaired. The magnet has subsequently been cooled and ramped up without problem. The second major activity was the change of the read-out and event building system from FASTBUS to VME. To reduce noise and dead-time with the 8-bunch operation of LEP, the front-end electronics was changed in the electro-magnetic calorimeters in both end-caps, as was done for the barrel a year ago. In addition, minor repairs were carried out, in particular on the TPC and the silicon micro-vertex detector, where a ladder had to be replaced which had been damaged by a radiation incident during a machine fill.

DELPHI

In preparation for the higher synchrotron radiation background of LEP 2, DELPHI has accepted the installation of a first set of additional masks. If successful, similar masks will be installed in the three other experiments during the next shutdown period(s). To obtain better coverage, resolution and granularity, the luminosity monitor was replaced by one built in the novel 'shashlik' technique. The silicon microvertex detector was improved by the

replacement of two single-sided layers by double-sided ones providing a second coordinate. Finally, the transition cones from the barrel to the end-cap regions of the detector have been covered better by additional muon chambers.

L3

This shutdown again saw two major activities for L3. After one of the immense doors had been equipped with toroidal magnet windings during the last shutdown, the remaining three doors were finished this time. All toroids have been powered successfully and are presently operating together with the main solenoid. Half of the new forward muon chambers have been installed and are being commissioned. In addition, smaller repairs were carried out, in particular on the microvertex detector.

OPAL

Compared to last year, OPAL had a much smaller program for this shutdown. A new background monitoring system was installed to protect the detector in case of strong radiation incidents by initialising a beam dump. Modifications and repairs were carried out on the luminosity monitor, the barrel pre-sampler and the microvertex detector. The read-out was modified for the jet chamber and the end-cap muon chambers to improve the performance for the 8-bunch operation of LEP.

FIXED TARGET EXPERIMENTS

CP Violation

The proposal (NA48) for an improved measurement of ϵ'/ϵ advances well although the design of the liquid krypton calorimeter has been a formidable challenge. Their prototype tests are now convincing and they are ready to place the construction contract. The electronics for this experiment is a major challenge for the collaboration who will be greatly helped by the ECP Division. The first tests of the charged particle spectrometer are still planned for 1995 but the calorimeter will only start its testing in 1996. Serious data taking will start in 1997.

Neutrino and Muon Experiments

The two neutrino experiments CHORUS (WA95) and NOMAD (WA96) continue to progress well and have just started their data taking.

The CHORUS Collaboration, which use an emulsion target, have tested the beamline successfully in the autumn of last year and have exposed a small sample of emulsion during the beamline test to try out the procedures to be used in the analysis. The emulsion is now fully installed in the neutrino beamline and they are starting their exposure.

The NOMAD Collaboration has installed the UA1 magnet in the BEBC hall and has equipped the magnet with most of the planned detectors. The start-up in April 1994 will be with only a few of the drift chambers which are to be provided by Saclay. They will only have the full detector ready at the end of this year but are taking valuable test data from now on.

The Spin Muon Collaboration (NA47) has taken considerable data on deuterons and will continue to measure on deuterons in 1994. They may continue in 1995 mostly on protons but the experiment should be completed before 1996.

Spectroscopy and Heavy Flavour Production

The Omega spectrometer will continue to run in 1994. The three experiments WA89, WA91 and WA97 will form the basis of the work of the final two to three years of Omega operation. WA89 will continue the study of charmed-strange baryons using the Σ^- beam. Experiment WA91 is continuing its search for non-standard mesons produced in the central region. WA97 is a heavy ion experiment which will study baryon and antibaryon spectra in Pb-Pb interactions starting in the autumn of 1994.

Heavy Ion Experiments

This programme was inactive during 1993. The Pb-ion injector will be ready in 1994 for the first physics runs with lead. In addition to the WA97 experiment, the experiment WA98 will measure the production of photons and charged particles in heavy ion collisions. WA99 will measure pair production and electron capture from the continuum in heavy particle collisions. WA100 is a brief exposure of plastic track detectors to relativistic Pb beams to allow calibration of a cosmic ray experiment. WA101 will measure cross-sections for electron capture and stripping, nuclear charge pickup, electromagnetic dissociation and secondary

interactions in the Pb beam. NA44 will continue its studies with the focusing spectrometer for one and two particle production. Finally, NA49 will start its programme of measurements with the large acceptance hadron detector.

ISOLDE

The new facility has operated very successfully in 1993. It is now well equipped with secondary beamlines and the General Purpose Separator is fully operational. The programme is now well established with currently 37 approved experiments from more than 50 proposals. The High Resolution Separator is now installed and will be tested during this year. Physics experiments with this separator are expected to start in 1995.

LEAR EXPERIMENTS

Meson Spectroscopy

The Crystal Barrel (PS 197), Obelix (PS 201) and Jetset (PS 202) experiment are studying antiproton-nucleon annihilation to search for new forms of matter (e.g. glueballs) which are predicted to have properties similar to ordinary S- and P-wave ($q\bar{q}$) mesons.

The special feature of the Crystal Barrel detector is a large solid angle and high resolution electromagnetic CsI calorimeter which - together with a Jet Drift Chamber for the momentum measurement of charged particles - enables it to fully reconstruct all annihilation events. The year 1993 was devoted to recording some additional 20 million events at rest and in flight to increase the statistics in some selected final states. In particular, the statistics on annihilations producing an η' and the final state $\pi^+\pi^-\pi^0\pi^0\eta$ has been increased by more than a factor 10 using special triggers. A high statistics study of the $(\pi^0\pi^0\eta)$ system is now possible - and a significant progress in the understanding of the E/ τ puzzle may be in reach.

Further analysis of the high statistics data taken in 1992 and 1993, with 3 pseudoscalar particles ($\bar{p}p \rightarrow \pi^0\pi^0\pi^0, \pi^0\eta\eta, \pi^0\pi^0\eta$) in the final state, has proven to be very successful. It has revealed new scalar resonances in the 1300-1600 MeV mass region, which shed new light on the scalar meson nonet.

In a combined analysis of the $\pi^0\pi^0\pi^0$ and $\pi^0\eta\eta$ channel, two new isoscalar $J^{PC} = 0^{++}$ states have been observed. The $f_0(1365)$ is a broad resonance with a width $\Gamma \approx 270$ MeV, while the $f_0(1520)$ is relatively narrow ($\Gamma = 150$ MeV). The

$f_0(1365)$ is also observed in the $\pi^0\rho^+\rho^-$ channel, and its main decay modes appear to be $\pi\pi$ and $\rho\rho$. It is therefore interpreted as the $(u\bar{u} + d\bar{d})$ isoscalar member of the scalar SU(3) nonet. The $f_0(1520)$ couples both to $\pi^0\pi^0$ and $\eta\eta$, and it has also been observed in $\eta\eta'$. It will now be of prime importance to obtain high statistics data on the $\pi^0K_S K_S$ final state to measure the precise decay branching ratios, which will allow an interpretation of this new state: it may be the long awaited 0^{++} glueball mixed with neighbouring scalar mesons.

Strong evidence for a new isovector scalar particle, the $a_0(1450)$ decaying into $\pi^0\eta$, has been found in the analysis of the final state $\pi^0\pi^0\eta$. Its interpretation as the $I=1$ member of the scalar SU(3) nonet would provide additional evidence that the $a_0(980)$ and the $f_0(975)$ are not $q\bar{q}$ mesons, but - most likely - $K\bar{K}$ molecules.

The PS 197 collaboration is presently constructing a microstrip vertex detector to increase its possibility to trigger on $K_S \rightarrow \pi^+\pi^-$ decays with the objective to accumulate a high statistics sample of the $\pi^0K_S K_S$ final state.

A special feature of the Obelix (PS 201) experiment is the possibility to study $\bar{n}p$ annihilations - a pure isospin ($I=1$) initial state - by using a charge-exchange cell in front of their liquid hydrogen target. In 1993, the analysis of the annihilation $\bar{n}p \rightarrow \pi^+\pi^+\pi^+\pi^-\pi^-$ has confirmed the existence of a narrow structure at $M=1664 \pm 45$ MeV and width $\Gamma = 62 \pm 2$ MeV, decaying into $\rho^0\rho^0$. Other interesting results are the confirmation of the strong OZI rule violation in the ratio of Φ to ω production in the process $\bar{n}p \rightarrow \Phi\pi^-$ or $\omega\pi^-$, and an unprecedented measurement of the stopping power of antiprotons at very low energies (down to 0.5 keV) on hydrogen and helium.

The Jetset (PS 202) experiment searches for new resonances in formation, by performing an energy scan of the reactions $\bar{p}p \rightarrow \Phi\Phi \rightarrow K^+K^-K^+K^-$ and $\bar{p}p \rightarrow K_S K_S \rightarrow \pi^+\pi^-\pi^+\pi^-$, using a hydrogen gas jet target inside LEAR. The reaction $\bar{p}p \rightarrow \Phi\Phi$ proceeds via a purely gluonic intermediate state and may therefore couple to a possible glueball in the scanned energy region. The mass scan of the 2.0 - 2.4 GeV region is now completed, with small step size in the region of the $\xi(2220)$. The partial wave analysis of the data is in progress, and the result will be available in 1994.

CP violation

The CP-LEAR (PS 195) experiment studies CP violating phenomena in the neutral kaon system by measuring interference effects and asymmetries between K^0 and \bar{K}^0 in their three main decay modes ($\pi\pi$, $\pi\pi\pi$, and $\pi e\nu$). The K^0 and \bar{K}^0 "beams" are tagged by the accompanying charged kaon in the CP-symmetrical reaction $\bar{p}p \rightarrow K^-K^0\pi^+$ and $\bar{p}p \rightarrow K^+\bar{K}^0\pi^-$, respectively.

In 1993, 120 million neutral kaon decays into $\pi^+\pi^-$ have been recorded and more than 45 million events allow the precise determination of CP violation parameters from the asymmetry between particle and antiparticle decays. With the same data, a more precise measurement of the K_S - K_L mass difference will be possible, and, for the first time, the CP and T violation parameters from the semileptonic and $\pi^+\pi^-\pi^0$ decay channels will be extracted.

Atomic Physics with Antiprotons

The PS205 collaboration studies the unusually long life of antiprotons trapped in high-n, high-l metastable levels of the antiprotonic helium atom $\bar{p} \text{He}^{++} e^-$. In 1993, the collaboration has achieved the first ever laser spectroscopy experiment on an antiprotonic atom. Using MW/cm² dye laser pulses of about 10 ns duration, dipole transitions from the metastable levels into non-metastable atomic states were induced, and the fast subsequent atomic cascade of the antiproton led to a sudden increase in the \bar{p} -He annihilation rate. The induced transition has been tentatively assigned to $(n,l) = (39,35) \rightarrow (38,34)$, with wavelength λ in the vicinity of 597 nm.

R&D ACTIVITIES

The challenging experimental environment of high-energy hadron colliders such as LHC has triggered a large variety of new development activities. By now 55 proposals have been discussed in the DRDC and 40 have been approved by the Research Board. The progress of the projects has continued to be very impressive, as could be judged from the presentations of the progress reports and from many publications. Four projects have been terminated since; 27 have been approved for continuation into a second year, 15 of these already

into the third year. PPE Division is participating in many of them with some 50 of its staff, including a significant number of our research physicists.

The activities supported under the LAA project continued as an important part of the R&D program, with ten staff supported by LAA working in the division. Much of this work was aimed at applications in LHC detectors. Some projects are being terminated.

TECHNICAL SUPPORT AND ADMINISTRATION

The support in the mechanical areas of detector development and construction for the approved experimental programme, including R&D projects, as well as mechanical support for the operation of the current large detectors, has been provided by the Detector Unit of the Division. Despite some recruitment, the staffing level has seen a net reduction of some twelve percent over the past three years (due to retirement and early departures). This obviously has very serious consequences on the support which can be provided. More recruitment is urgently needed.

The Division continues to support an ever growing visitor programme both through the Users' Office and through the Administration and Secretariats group.

ELECTRONICS AND COMPUTING FOR PHYSICS DIVISION (ECP)

SPS and LEAR Programmes

A sustained effort of the division in the last six months has been in the preparation of the neutrino experiments CHORUS and NOMAD. This effort covers preparation of the neutrino beam, electronics design and construction and software for both experiments.

The neutrino beam elements were successfully tested with particles late in 93. Major work carried out in the intervening six months consisted in calibrating the silicon detectors and associated electronics for muon flux monitoring, as well as refining procedures and preparing spares in view of an expected long operation.

In CHORUS, the CCD cameras (58 units) for the readout of the scintillating fibre calorimeter were installed and integrated in the data acquisition system.

In NOMAD, the installation of the control room was completed and the electronics for the electromagnetic calorimeter, the pre-shower and the transition radiation detector were put into operation. A new data acquisition software system (CASCADE), based on OS-9 and UNIX, was also consolidated during this period, following the initial tests in autumn 93.

For both experiments the preparation of the reconstruction and analyses software was completed.

At the time of writing, both the neutrino beam and the experiments are operating successfully.

Routine work has been carried out for a number of experiments which are taking data at LEAR or at the SPS proton fixed target programme: sizeable effort has been devoted to improvements in the trigger of CPLEAR, and to the switch-over to WA91 in the OMEGA spectrometer.

Work for experiments in preparation has been dominated by NA48. The design of the liquid Krypton calorimeter electronics has made progress and some components are on order. Hardware and software components for high speed data collection and switching (data merger) have been designed and built. Preparation for the wiring of the experiment and its control room on the floor is well advanced.

LEP Programme

Shut-down work for the LEP experiment has proceeded according to schedule. Sizeable re-wiring has taken place in the experimental areas of ALEPH and DELPHI. The re-engineering of the General Surveillance System (GSS) has been completed for OPAL. A new control system has been installed for the ALEPH magnet.

Major electronics effort has been devoted to the trigger of DELPHI and OPAL, to the new luminometer of DELPHI and to the data acquisition of ALEPH.

These hardware improvements have requested matching changes in the data acquisition software.

All work was successfully completed in time for the LEP start-up

R&D for LHC

The R&D in the field of trigger, data acquisition and software for LHC experiments has continued vigorously, under scrutiny by the DRDC and in close link to the LHC collaborations. Many of the development have been brought to maturity for field tests in beams at SPS start-up.

Notable achievements in the recent past are the encouraging performance of the digital processing chip for calorimeter readout in RD16 and satisfactory test of the low-cost SCI interconnect chip in RD24.

New projects have started, in collaboration with industry, in the field of advanced software methodologies applied to problems specific to HEP.

Other topics

The division has given support to the LHC collaborations in setting up a communications environment based on the World-Wide Web (WWW), an information distribution software system based on the Internet. The principles and protocol of the system have been specified at CERN, to serve the needs of the HEP community. A number of software products compliant with the protocol have appeared on the market and a real explosion in the use of the system outside HEP has taken place in recent months, covering many areas of the academic and business world.

COMPUTING AND NETWORKS DIVISION (CN)

Introduction

The implementation of the move from mainframe-based to distributed computing, decided in 1993, is gathering momentum.

The capacity and data access capabilities of the successful Centrally Operated RISC Environment (CORE) is being upgraded to fulfil the evolving batch processing needs of the LEP and LHC experiments. CORE will take over the major part of CERNVM's batch load, allowing a significant down-sizing of this last mainframe service at the end of the year.

At the same time, UNIX-based interactive workgroup services and support for workstations and PCs on the desktop are being built-up with a view to final de-commissioning of CERNVM in 1996.

With LHC in mind, much thought and discussion is being devoted to future off-line applications and the concept of a common framework that would improve the reliability and ease of maintenance of HEP software developed in a geographically dispersed environment. Other key areas receiving attention in this context are teleconferencing, of much interest to such large collaborations, and data handling, where evolution towards new automated technology and integrated hierarchical management is considered to be of high importance.

Physics Data Processing

A plan is being made for phasing out the remaining central IBM mainframe. This will involve a major "down-sizing" of the configuration at the end of 1994, with final de-commissioning scheduled for 1996. The batch data processing and tape handling services are being moved to CORE, which is therefore undergoing a major upgrade, also to satisfy the evolving needs of LEP and LHC. The central services now have about 1.8 Terabytes of disk storage capacity.

Usage of the automated tape handling facilities has been growing rapidly, with over half of the 22,000 weekly tape mounts now handled by the robots. Planning of the medium-term evolution of tape equipment and services has started, with the aim of exploiting new technology to increase overall capacity and the level of automation. Technology for integrated management of all of the disk and tape storage is also being investigated.

Applications development work within the ESPRIT-funded GPMIMD2 parallel computing project has progressed well, in collaboration with ECP Division. Involved are: a parallel version of the NA48 Monte Carlo program; second level

trigger algorithms (with the EAST collaboration - RD11); the GEANT Monte Carlo program (in collaboration with the CRS4 parallel computing laboratory in Sardinia); parallel data analysis. A team of four Fellows has been preparing applications for the CS-2 parallel computer whose delivery is expected imminently. Further FORTRAN 90 compiler testing has been undertaken.

Distributed Computing Infrastructure

The focus for 1994 is to put in place a solid infrastructure for distributed computing. Specific objectives include setting up UNIX-based workgroup environments for the two LHC experiments and addressing the needs of interactive users who will have to migrate away from CERNVM over the next couple of years. The UNIX Migration Task Force, UMFT, is presently identifying the set of UNIX tools which will be fully supported. Despite the emphasis on migration, this selection should benefit the entire UNIX community.

The cost-effectiveness of the well established VMS-based services (VXCERN) was significantly increased in January by a 'right-sizing' exercise in which the VAX 9000 mainframe was replaced with a cluster of workstations.

UNIX desktop services are based on the AFS file system for file storage and sharing and ASIS for provision of application software. The dependence of the Chorus experiment on these aspects, as they start to take data, has sharpened the focus on their development. AFS storage capacity will be doubled by mid year and reliability issues are being addressed as it moves to be a production service. Its backup is being moved from Exabytes to Digital Linear Tapes, software has been upgraded to the latest level and operational procedures are being tightened up. ASIS underwent a major restructuring in January when the master copy was moved to AFS. Testing of the first version of procedures for installing and updating applications on the seven supported platforms is well advanced.

To aid system maintenance of individual machines, a Shrink-wrapped UNIX Environment, SUE, is being developed. A successful first version for RS6000 is now being extended to other platforms. Based on work by DESY, and with their help, substantial progress has been made on scripts to set up a 'HEP standard' UNIX environment for users. Current work focuses on X-specific aspects.

In the area of PC support, NICE is consolidating Home Directory File Services support based on Netware 4 and will add provision of application services for the Macintosh community in collaboration with AS Division.

Networking

The internal computer networks continued to run well, with sustained growth in traffic. The backbone network now includes a central 3.6 gigabit/second switch. A major call for tenders was issued for the upgrade of the site-wide cabling, to improve reliability and cope with future growth. External network traffic also continued to grow, and CERN was connected to Europanet, one of the major Internet service providers in Europe. Work in support of video-conferencing over the Internet continued, especially for the ATLAS and CMS collaborations.

Applications Support and Databases

GEANT3.21 has been released with major improvements compared to the previous versions. These include: performance enhancements (by re-writing the tracking), more powerful geometry (via Boolean operations and divisions along arbitrary axes), better logic and important bug fixes in the physics, and realistic renderings (via ray-tracing). A new version of PAW and associated packages was released with version 94A of the CERN Program Library. A film was prepared for CHEP'94 and will also be used at the CERN School of Computing.

The first release of the CERN Program Library for 1994 was made during March. For this release the VMS versions of the libraries have been made available on ASIS for the first time. In collaboration with JINR, releases have also been made for MS/DOS, Linux and Windows/NT. An installation guide has been developed and distributed, significantly reducing the amount of effort required to install the CERN Program Library.

Assistance continues to be given to users migrating ORACLE applications from CERNVM. The EMDIR server was moved from the VXCERN cluster to the central ORACLE database server and new EMDIR clients, including an OpenVMS version, were released. The LEP logging database was migrated from Oracle version 6 to 7 and the SPS/LEP measurements database was installed.

Computing for Engineering

Significant for digital electronics design was a build-up of support and on-site training for the Cadence CAE suite, along with updated programmable logic design kits and design documentation software. With the introduction of LabView 3, portable virtual instrument applications can now be written.

Simulation of analog electronics benefited from SABER v3.2 introduction and first tests of a network licensed Windows version of the popular PSpice package. In response to a long-standing demand, writing of SABER/MAST simulation models could start, in collaboration with user Divisions.

Euclid3 came into production on VMS for mechanical 3D modelling while work continues on the move to UNIX. A focus of attention has been CAD data management, transformation and exchange, with LHC experiments especially in mind. CADGE, a prototype OO-based interface, now transfers detector data between GEANT and the ISO standard, STEP.

Support for engineering packages on PCs is being consolidated in the NICE environment with the introduction of licence monitoring and access control software, and a network version of P-CAD. Associated work on PC evaluation, CD-ROM servers and Novell server optimisation benefits the whole PC community. In an on-going collaboration with St Petersburg Nuclear Physics Institute, PC-BANK, a component database for P-CAD, was installed.

In microprocessor support, Microware's FasTrack X-based OS9 development environment was tested, while the new GCC and C++ compilers found increased use. LynxOS v2.2 was introduced. A new Ethernet driver was made to work for CERN's technical training PCs. The "VMEbus Extensions for Physics" workshop was jointly organised with ECP and ESONE. There was good progress in the open-library joint project on the Nu Thena Foresight system simulation tool. A Futurebus+ evaluation has started in collaboration with ECP Division.

Computer Operations Infrastructure

Logging of operator actions has been automated and a major effort is under way to improve infrastructure management, including CAD-generated installation plans, cleaned-up power, interconnection and network wiring, a computer-based inventory of systems and their operational requirements, and improved lighting in the Control Room and User Area.

II TECHNICAL DIVISIONS

- Accelerator Technologies Division (AT)
- Mechanical Technologies Division (MT)
- Proton Synchrotron Division (PS)
- SPS and LEP Division (SL)
- Technical Support Division (ST)
- Technical Inspection and Safety Commission (TIS)

ACCELERATOR TECHNOLOGIES DIVISION (AT)

AT activities have continued on the three main fronts of machine exploitation, including the completion of the shutdown work, and advancement of the LEP2 and LHC projects.

1. CRYOGENICS

Operation of existing cryoplants and cryogenic support to physics experiments

The cryoplants for LEP1 and fixed target experiments restarted successfully after scheduled maintenance, which this year included a thorough preventive overhaul of all LEP1 screw compressors. Cryogenic support was in particular given to experiments NA49 (incorporation of a second vertex magnet; preparation of alternate operation of NA49 with RD5) and ALEPH (helium leak on thermal-radiation shield). Tendering has started for progressive delegation of cryoplant operation to industry in the forthcoming years.

Cryogenics for LEP2

Commissioning of the new 12 kW/4.5 K cryoplants at Point 2 and 4 for LEP2 is under way. Liquid-helium distribution systems at Point 2, 6 and 8 are operational. Installation of liquid-helium transfer lines in Point 4 of LEP continues as scheduled. A new 400 W/4.5 K cryoplant cooling SPS superconducting cavities has successfully passed its acceptance test.

Cryogenics for LHC

The cryogenic system for individual-magnet tests has been put into service with the successful test of the first 10 m-long model of a LHC dipole. A study contract is being placed with specialized firms to upgrade the LEP2 cryoplants for use with LHC, and two prototype cold compressors to be used in the LHC magnet test facility in hall SM18 are being ordered.

2. MAGNETS

Existing accelerators

At the PS, the new magnet thermal protection system was completed, and work continued on the reconditioning of poleface windings. A ferrite-kicker system for observation of the vertical distribution of lead ions has been provided for the PS-Booster. Magnets have been overhauled for the LIL and PS experimental areas. At the SPS, an extensive program of control and preventive maintenance was executed during the winter shutdown. The project for reconditioning radiation-damaged main dipole coils has been launched, and rebuilding of a first series of lattice quadrupoles has been started.

The modifications to the Field Display System for better definition of the LEP energy have continued, this included the preparation for the installation of NMR probes in two of the ring dipoles. Backleg windings, to modulate the field in the LEP lattice quadrupoles and calibrate the beam position monitors, have been installed in the straight sections adjacent to the experiments. LEP2-related work has included the repositioning of quadrupoles, corrector dipoles and tilted quadrupoles in the even-numbered straight sections, and the installation of four of the new superconducting quadrupoles for the low-beta insertions at points 2 and 8.

LHC

The first 10 m long, twin-aperture superconducting dipole, a result of a collaboration between CERN and INFN, has been delivered to CERN. The excellent performance of this dipole, completely built and assembled in its cryostat by industry and tested at CERN, is a major milestone in the LHC magnet R & D programme. At 1.8 K, the magnet exceeded a magnetic induction of 8.65 T - the LHC operating field - without any premature quench and reached 9 T after 2 quenches. Other 10 m long magnets will be tested soon.

The second 3.5 m twin-aperture quadrupole prototype, provided by Saclay, has reached within a few quenches a gradient of 250 T/m. This is well above the LHC operating gradient of 216 T/m. One such quadrupole has been assembled as a short straight section with the dedicated busbars and stack of high current diodes. This short straight section will be installed in the string test facility.

Tooling for winding, end spacers, and cables have been procured for the short magnet models of the new LHC dipole design.

3. VACUUM

The activities involved shutdown work on the various machines.

The layout transformations for LEP2 in the points 4 and 8, the installation of 12 additional collimators and the rearrangement of the low-beta sections around all even points have required work on nearly one third of the machine circumference. In the preparation for high energy operation a pair of test masks to reduce the photon background has been installed in the Delphi beam pipe. Vacuum work for the LEP superconducting cavities has continued; a program to measure secondary electron yields has been started to find a solution to the problem of multipacting in the cavity couplers. At the PS and in the PS Booster the main effort has been concentrated on improving the vacuum for the lead ion running later this year.

At the CLIC test facility the manipulation of cathodes can now be done under uhv conditions.

LHC design work has continued and orders for prototypes of the cold bore vacuum tube, and beam screen have been placed. In collaboration with Novosibirsk, samples of the beam screen are being prepared for measurements of the photon induced desorption coefficients at cryogenic temperatures. Design work for a cold vacuum test section to be inserted in the EPA ring is on going.

4. COOLING AND VENTILATION

Local area supervision networks are being installed at the even points of LEP using Labview to monitor water and air-conditioning systems. For the LHC project the space and budget needs for the outline design scenarios are being produced. Help is being given to the ATLAS and CMS collaborations to determine the air conditioning and cooling systems for their detectors.

The Group has liased with the ST Division in the preparation of market survey and tender documentation for a future Operation and Maintenance contract to cover all CV installations at CERN.

5. SURVEY

A complete levelling of LEP has been made leading to the realignment of 140 quadrupoles. The results obtained at start-up showed the beneficial effects of this refinement. In addition, the low-beta magnets in P8 have been equipped with hydrostatic levels in order to have a monitored control of any movement. Other measurements and realignments were made on the SPS, the AA and some transfer lines. One hundred and thirty elements for LEP 200 were aligned, and the initial survey of the LINAC III has been continued. Many experiments have required measurement and realignment following modifications; similarly for the newly installed experiments, CHORUS and NOMAD.

6. INDUSTRIAL CONTROLS

An agreement has been concluded with ABB-Sweden in which CERN is named Beta-Tester for both hardware and software in a new line of Process Controllers, thus contributing its know-how in the context of an industrial cooperation.

All LEP-2 Cryogenics controls are now on uninterruptable power supplies with up to 8 hours stand-by service in cases of emergencies.

For LHC the IC group has taken part in the successful tests of the I1 magnet on the Magnet Test Bench in SM18 by providing the slow data acquisition system and the supervision for the cryogenics. For the String Test facility the supervision needs are being defined; the data acquisition system has been specified and the invitations to tender have gone out.

7. DATA BASE AND SOFTWARE ENGINEERING

The DataBase Support team has made considerable progress towards providing software for engineering purposes. The systems cover configuration and equipment management and project planning. Preparation to transfer all data from VAX to a more cost effective UNIX platform by the end of 1994 is in progress.

In the area of Software Engineering, the standards of the European Space Agency have been evaluated and applied successfully on a subcontracted pilot project (SPS Software Interlock System) conducted in the SL Division.

OBLOG CASE, a Portuguese CASE tool based on a novel Object Oriented paradigm (a spinoff of an ESPRIT research program), has been successfully applied to the development of the CLIC (CERN LInear Collider) automatic alignment software.

MECHANICAL TECHNOLOGIES DIVISION (MT)

1. MECHANICAL ENGINEERING STUDIES

The three groups for the mechanical engineering support for the Accelerator Sector have supplied to their clients about 40'000 hours in the first half of 1994, for making design studies and manufacturing drawings.

1.1 MACHINES CONSOLIDATION GROUP (ESM)

Maintenance and consolidation of all the existing CERN accelerators still use about half of the resources of the group, it is worth mentioning the following studies made during the first part of 1994:

- the Faraday Plasma Ion Source for ISOLDE
- the electron gun cooling for PS
- the 40 MHZ cavity for the PS, including its short circuit
- the RFQ2 project for the Linac 2
- the electrostatic separators for LEP
- the Kevlar window for NA48 experiment
- the travelling wave cavity coupler for SPS machine

The other half of the ESM group is continuing the project studies for future accelerators (LHC, LEP2, CLIC) which concern mainly cryogenic components and devices for LHC, the LHC beam dumping system, the 400 MHZ couplers for LEP2.

A section of the group which is in charge of the management of the two external support contracts of the division for making detailed drawings has also implemented a new modern drawing reproducing system which has been put in place at the end of 1993: with this new equipment, anybody equipped with a PC is able to produce paper copies directly from his desk.

1.2 LEP2 AND INFRASTRUCTURE GROUP (ESI)

Three main design fields of activities are concerned:

For LEP2

Finalisation of vacuum system installed during 93/94 shutdown and definition of the 94/95 shutdown lattice. New enlarged vacuum chambers and last beam instrumentation components design (main activity

concerned optical devices, scanners, 60 new collimators of 6 different models, of which 50 are already installed in LEP), modifications of LEP experiments vacuum chambers, improvements in insertion regions around the new SC quadrupoles.

Design of sputtering facilities for couplers, rinsing system, handling devices for the LEP2 SC cavities.

For LHC Project, infrastructure design work

Definition of necessary volumes for implantation of cryogenics, power converters, cooling and ventilation facilities. Definition of volumes and services for the two large LHC experiments and installation simulations (underground caverns as well as new surface infrastructures) for different LEP points. Design work on the test facility at SM18.

For SPS physics program:

Design support for cryogenic layouts in fixed target experimental areas.

Remote handling activity: Renewal of existing remote handling equipment has been continued. Installation and commissioning of lifting equipment on all CERN site are still part of the groups duty.

1.3 LHC MAGNET DESIGN SUPPORT GROUP (ESH)

The main activities of the LHC Engineering Support Group (ESH) in the first part of 1994 are closely linked to the actual LHC priorities. The assembly of the first short straight section to be installed in the String Test of SM18 has been completed. This short straight section includes most features required for the future machine: the main quadrupole, dummy corrector magnets, protection diodes and bus bars.

The procurement of the first cryogenic feedbox for the dipole test bench has been completed. The participation of the group in its successful operation (commissioning and realisation of the junctions) with the first LHC prototype dipole has been important. In parallel the group has been engaged in studies for the new high priority dipole model program, and participates in the specification task force for components for future prototypes. Concerning vacuum, the group has completed the first phase of the LHC beam screen specification and design, delivered a test apparatus for photo-desorption studies at cryogenic temperatures to the Vacuum group, and produced many preliminary studies of components. The foundation work linked to mechanical measurements of material properties at low temperature, procurement and calibration of

mechanical transducers, and test of LHC components (bellows, seals, etc.) has progressed satisfactorily.

The relevant section of the group has continued its assistance to the four LEP experiments in particular procuring and installing radiation absorbers for Delphi, and a spare transparent vacuum chamber in Beryllium for all 4 experiments.

2. MANUFACTURING FACILITIES GROUP (MF)

The MF workshops have been mobilised essentially by LEP 2 and LHC activities during the first half 1994. A few notable examples are listed below:

- Two BEW vacuum tanks for wire beam scanners to be installed on the LEP machine.
- A photo-desorption device to measure degassing out of different materials, when submitted to high energy photon or electron bombardment.
- A set of nine BBCHN collimators for LEP 2.
- Fabrication of a set of six RF extensions for the LEP 2 RF superconducting cavities, to serve as prototypes for the construction of a subsequent larger series.
- A tank for the Titanium vacuum deposition on various RF components of the main couplers for the LEP 2 superconducting cavities (chokes, ceramic windows, antennae, RF extension, etc.).
- Modification of the ceramic window assembly on an existing set of RF couplers, manufactured by outside industry, in order to improve the brazing process.
- Assembly in the workshop of the short LHC straight section for SM 18.

It was nevertheless possible to satisfy the support requests usually originated by the accelerators shutdown during the first quarter and develop a few interesting items such as the High Voltage Pulsed Horns for the new neutrino beam and the mechanism for the short circuit test bench of the RF 40 MHz prototype cavity foreseen for s.s.77 on the PS machine.

3. SURFACES AND MATERIALS GROUP (SM)

Over and above the normal service and current project activities in the surfaces and materials fields, the necessity to titanium coat the main couplers of the LEP2 superconducting cavities has required a redefinition of priorities with the MT-SM group and resulted in a heavy additional workload during the first half of 1994. First of all it has been necessary to study the physico-chemical characteristics of copper layers produced by different deposition techniques, measuring such parameters as surface rugosity, RRR values, chemical composition and impurities, secondary electron emission coefficient as well as thermal and dynamic degassing properties. The results of these detailed investigations will be used to select the copper coating method for the stainless steel main coupler components prior to titanium sputter coating. For this latter operation good progress has been made with the preparatory work of designing and procuring the components for the three sputtering systems needed to coat the different main coupler subassemblies. The titanium coating process parameters for the most complex components are being studied with the aim of defining optimal conditions for a start of series treatment during the Summer. In view of the urgency of this programme other activities have had to be slowed down in order to free the resources needed for this work. Nevertheless it must be mentioned that all the sections of the group have continued to supply services at a high level to the whole CERN population during the period under review.

4. OTHER ACTIVITIES

4.1 INFORMATICS SUPPORT SECTION (DI-SI)

The main achievement of the Informatics support section was the migration to ORACLE 7 of the new application JMT which is used for managing all the jobs performed in the division for its clients. At the same time, a new version of the ODD application for managing all the drawings produced by the division, including their electronic approval and viewing on a PC screen, is being designed. CAD support has concentrated on migration to UNIX operating system as well as the installation of the next Euclid version called Euclid3, which should be operational before the summer holidays. This was done on top of the normal activities of the section which cover the maintenance and user support of the local computer network, common to the AT and MT

Divisions, the support for CAD packages and for their applications which allow the exchange of data and the printing and archiving of drawings.

4.2 INSTALLATION GROUP (IN)

The group was as usual involved in the completion of the normal machine winter shut down.

The installation phase of the project related to the "Clean Rooms" for the photomechanical technologies is underway

The group participates in the studies of the long LHC magnet assembly facility to be installed at CERN.

The former SC area has been completely dismantled and the BEBC He hall is being refurbished.

5. COORDINATION FOR LHC

Two interdivisional projects are coordinated within the MT Division.

5.1 The LHC magnet test string in building SM18, for which the infrastructure is now completed and the installation and assembly proper will start in June 1994. The aim is to have one LHC short straight section cryostat and at least two 10 m dipole prototypes installed in series, cooled down to 1.8 K and powered at nominal current for the end of this year.

5.2 A facility for assembling long SC magnets at CERN: A small task force across divisions has been set up and started by reviewing all the necessary operations for assembling LHC magnets, starting from collared coils and finishing with the magnet installed in its cryostat (Magnet repair is also envisaged). This facility will require the rejuvenation of hall 181 (former Hall I1 of the ISR). The central equipment will be a large press, 18 m long, capable of delivering 1500T/m, with welding and machining facilities attached to it and for which the specification is now completed and sent to tenderers.

PROTON SYNCHROTRON DIVISION (PS)

As normal, the major part of the installation and maintenance work for 1994 was carried out in all the 8 accelerators of the PS Complex during the long Winter shutdown.

An unusually large amount of work was carried out in and around the PS Booster, as part of the preparations for this year's inaugural Lead ion run. The cables and ferrites of all the kicker magnets were replaced. The replacement of the computer control system has been completed, as part of the PS controls renovation project. New horizontal feedback systems for all four Booster rings have been installed. The Booster vacuum has been improved for the acceleration of the Lead ions later this year with the addition of titanium sublimation pumps. This additional pumping, along with the replacement of the old kicker ferrites and a general clean up of the vacuum system, will increase the transmission efficiency of the Lead ions during acceleration. A new digital beam control for the RF system, needed for the acceleration of ions, has been shown to work and is presently under test. New, better shielded beam current transformers have been installed in the injection line to monitor the very low ion currents. The power supplies for the injection septa have been modified to accommodate the lower revolution frequency of the Lead ions. Several modifications have also been made to the Booster Main Power supply to allow for a faster acceleration cycle for the heavy ions.

To prepare for the acceleration of Lead ions in the PS, two new septum magnets have been installed in the PS and major improvements are underway on the pick-up systems for closed orbit observation and trajectory measurement in the transfer lines. The stripping foil, which will fully strip the Lead ions from charge state 53+ to 82+, after ejection from the PS and before they are injected into the SPS, has been installed in the TT2 line. During the shutdown there was a complete realignment of the TT2 and TTL2 transfer lines from the PS to the SPS and the AAC. The over-temperature protection circuits on the PS main magnets were replaced, and various modifications were made to the LINAC2 ion source protection against high-voltage breakdown.

During the LPI shutdown the flexible water cooling pipes were all replaced and the cooling capacity of the system was increased. An RF pulse compressor

(LIPS) was installed after the first klystron modulator of the positron linac in order to lower the required RF power and improve the positron production by using higher capture fields. In order to improve the efficiency of operation of the LPI electron irradiation area (LEA), which is run between LEP fillings for the irradiation of various experimental physics detector components, the beam instrumentation and the control of the table on which the components are mounted, have been upgraded.

Finally at LEAR several improvements were carried out on the electron cooling system itself and for the magnetic compensation of the increased solenoid field associated with it.

At the end of 1993 GSI delivered the second and third inter-digital tanks for the new Lead ion Linac. After verification of the field distribution and the installation of services, RF power from CERN 200 MHz amplifier chains was applied to both tanks and they were brought up to full nominal operating levels quite quickly. Two 100 MHz amplifiers and the first Linac tank were delivered to CERN at the beginning of March 1994. The installation of the 100 MHz amplifiers had been carried out in parallel by a joint CERN/GSI team, and this tank has also been powered up to its nominal RF level.

In mid-April, the missing link in the lead accelerator chain, the RFQ, was delivered by Legnaro. After field measurements and vacuum testing the RFQ was transported to its final position for installation and RF formation in anticipation of beam tests. For these tests the first tank of the new Linac has been moved sideways, in order to install a temporary beam measurement line. The first measurements have shown an accelerated beam of more than 70 micro amps.

Work on the development of a Laser driven ion source continued with some most encouraging results. 4 mA of Al^{9+} and Al^{10+} have been produced in a 5 microsecond pulse, and subsequently accelerated through the LBL RFQ. Heavier ions can be produced by the Laser source, but the choice of this atomic mass for the current test is dictated by the existing RFQ.

On the basis of the information gathered during the "LHC Test" at the end of 1993, all prototype hardware and modifications made for the test worked as anticipated. Virtually all ingredients of the scheme were addressed and we are confident that we can indeed fulfil LHC requirements. The beam intensities and

emittances obtained are comfortably within the LHC specifications, if one allows some margin for the full scheme, which will use all four (instead of one) PS Booster rings. A definitive project proposal "Upgrading of the PS Complex as LHC proton pre-injector" is being prepared, including detailed cost and manpower estimates.

The studies in the framework of an International Collaboration on R&D for Linear Colliders operating at 30 GHz have been continued.

Solutions to generate the CLIC drive beam made of a 12ns burst of electron bunches, of total charge $7\mu\text{C}$ have been explored. The investigations of pre-acceleration ranged from induction accelerators to boosted S-band RF guns. To create then the required 30 GHz time structure, one scheme being analysed is the sequential and compressed bunches, based on solutions including a magnetic switchboard or an isochronous collector ring. The alternative technique of using the bunching process inherent to a free electron maser is being studied experimentally.

Work on the CLIC Test Facility continues to advance. In order to fight the strong wakefield effects in the CTF main accelerating section, a 4 cell booster section with strong accelerating fields has been installed behind the regular 1 1/2 cell RF gun. This will increase the momentum of the beam up to 15.5 MeV/c. The system has been baked out and the RF conditioning has started. A new CTF experimental run with beam is scheduled early this summer. For this run an extra modulator and klystron station is being prepared in order to reduce the heavy beam loading induced by the high charge of the beam in the main accelerating section.

The PS Complex officially started up on March 14. However, due to all the installations or modifications that had taken place in the PS Booster, the first proton beam was only scheduled in this machine on March 24 and then only as a test of the new control system. Normal proton operation at the PS was not foreseen until after Easter and, for this reason, the general start-up of the PS was planned with leptons. However the protons from LINAC2 were used by LEAR for several weeks of machine development mainly devoted to electron cooling studies, putting into service a new deceleration cycle and studying beam stability at low momenta.

LPI started well, after systematic hardware tests and delivered its beams to the PS as scheduled. The following days were spent solving the numerous problems that are encountered after a long shutdown. Finally the lepton beams were sent, on time, by March 25 to SPS, for its own start-up. Initially, as during the major part of 1993, four cycles out of the 14.4 second super-cycle were used for SPS/LEP filling (2 cycles with 4 bunches of 10^{11} e+ and 2 cycles with 4 bunches of 10^{11} e-). However, after 1 week of "four cycle" operation, the PS/SPS switched to "8 bunch mode", in order to use only two cycles per super-cycle for the normal SPS/LEP transfer (1 e+ cycle and 1e- cycle). This mode of operation will continue throughout 1994.

After Easter the proton beam operation started at the PS, and a series of serious problems arose. Initially things looked fairly reasonable, apart from some short delays for last minute installations in the PS Booster. AAC started well with the 3.5 GeV/c proton test beam in the reverse mode via the loop, and then switched to the inverse polarity for a one week, proton machine development session, which was mainly devoted to adjustment of the different AC or AA beam cooling systems and acceptance studies in the AA and AC rings.

Unfortunately the last three weeks of April were seriously disturbed by a long list of breakdowns and/or operational problems. There was a series of vacuum leaks on the high current connection of the new septum magnet in the PS straight section 16, which finally led to the septum being removed for repair. There were also a number vacuum leaks in the PS Booster. Defective interlock circuits caused several power supply breakdowns on PS and PS Booster septum magnets. There were several problems with the new PS water station, and numerous interruptions to accelerator operation due to general timing and sequencing problems on the PS. All this unfortunately meant that there was at least a 7 day delay in supplying even low intensity proton beams.

The AAC start-up went remarkably smoothly in spite of all the difficulties that were encountered in the PS itself. However, antiproton production was started 7 days behind schedule, albeit with a reduced intensity 26 GeV production beam. Once enough antiprotons had been produced and stored, there were again very serious difficulties in the antiproton deceleration in the PS and subsequent transfer to LEAR, which were provoked by new beam control electronics and large difference of energy between AA and PS on the deceleration cycle. There

were also several AA stack losses, caused by small fluctuations on the AA QF power supply. This supply had already caused several antiproton stack losses in December 1993, but is still giving problems, in spite of a complete overhaul of the supply in question during the shutdown. Apart from problems with the AA QF power supply, the initial antiproton accumulation rate of over $1 \cdot 10^{10}$ pbars per production cycle per hour is very encouraging, in view of the reduced intensity production beam. However, as with all the machines, the supply of beam to AAC has been badly affected by the large number breakdowns.

After various machine development sessions with protons on the electron cooling system and on the new LEAR deceleration and extraction cycle (the vertical tune has been changed), LEAR was scheduled to switch to antiprotons on April 21, but the first reasonable pbar transfers were only achieved by April 28. The setting up of the new deceleration cycle using electron cooling went quite smoothly, once all the many transfer problems had been overcome, and confirmed the improvement seen with protons for the deceleration of pbars. The first beams were ejected to the South Hall pbar users at the beginning of May (6 days later than scheduled).

SPS AND LEP DIVISION (SL)

The SPS Machine

The year started with the customary winter shutdown. As usual, most of the activities during the shutdown were related to routine maintenance of machine components and general services, including electrical power distribution, cooling and ventilation.

A few new components were also added to the machine, mainly in order to improve its performance as a LEP injector. A Robinson gradient wiggler is expected to lengthen the lepton bunches in the SPS and hence raise the threshold current for a vertical transverse instability which occurs at an energy around 10 GeV when the bunches become short due to adiabatic and radiation damping. Furthermore, a second bi-module superconducting cavity has been installed to allow an increase of the extraction energy to LEP from the present 20 GeV to around 22 GeV. This should lead to an increase of the maximum bunch current in LEP at injection by at least 10% which will be important for LEP2 operation.

The SPS is an ageing machine and many components are showing serious signs of fatigue. The number of main dipoles and quadrupoles which had to be replaced during the shutdown was higher than in previous years and a vigorous repair programme is under way in the AT Division.

The SPS control system based on 16 bit Norsk Data computers linked by a proprietary network was some 20 years old and had reached the end of its useful life-time. During the shutdown it was replaced by an entirely new system with industrial PCs for front end computing and workstations in the control room for a modern operator interface. All computers run a UNIX operating system and are interconnected via a network based on a token ring backbone and local ethernet segments.

For the first time, the work that could be done during the SPS shutdown was seriously limited by the available financial resources. Thus, the planned replacement of radiation damaged cables in the beam transfer tunnel towards the

West experimental area had to be cancelled since no project authorization could be obtained for the required 1.2 MCHF.

SPS operation with leptons started up very smoothly at the end of March. Only one positron cycle and one electron cycle are now used per 14.4 second supercycle, with eight bunches being accelerated on each of the lepton cycles. This makes the operation of the SPS and its lepton injector chain easier than with two positron and two electron cycles per supercycle and only four bunches accelerated in each of them.

The SPS start-up with protons which began on 11 April was more difficult than expected and several serious problems were encountered. One of these problems, some initial difficulties with the new control system, had been anticipated. Software worth about 100 man-years had been either ported to the new system or entirely re-written and a few of the unavoidable bugs could only be detected when the SPS was operated with beam.

A more important problem was the unreliable operation of the proton injector chain which is described elsewhere and which led to many interruptions of the start-up procedure.

The problems in the SPS itself mainly came to light when first attempts were made to raise the proton intensity. The new superconducting bi-module mentioned above, while providing an extra accelerating voltage for the lepton beams of some 16 MV, also introduces an undesirable additional longitudinal impedance during proton operation. To simplify the start-up period, the new bi-module was passively damped. Nonetheless, with the added impedance, other changes on the existing bi-module became essential. The radio-frequency feedback system has been pushed to its theoretical limits and an extra one-turn delay feedback system per cavity has been installed. All these measures have led to a significant reduction of the residual impedance of the four superconducting cavities installed in the SPS and the proton beam is now stable at the present intensities of more than 2.5×10^{13} protons per pulse.

Another problem in the SPS emerged when intensities in excess of 10^{13} protons per pulse were extracted through the West extraction channel. The first deflecting

device of this channel, an electrostatic septum, became unstable. Proton losses intrinsic to resonant extraction, combined with the effect of ions created by the circulating beam, have caused sparks between the high voltage electrodes of the septum which is normally operated at a field of more than 100 kV/cm. This effect and means to cure it, are presently under study. Meanwhile, the SPS interlock system has been modified in such a way that fast resonant extraction for neutrino physics is disabled for only one proton cycle in the event of a spark, while slow extraction for the other users remains unaffected.

The SPS is now well under way towards intensities exceeding 3×10^{13} protons per pulse.

The LEP Machine

LEP stopped for physics on 22nd November 1993 in order to carry out the very heavy workload for the winter shutdown. The majority of this work was associated with the LEP2 energy upgrade project, particularly in the even points. More than 430 different elements were replaced or installed.

The LEP2 layout for the low insertions was installed and in the straight sections around ALEPH and DELPHI all of the elements were re-positioned to accommodate the future installation of the superconducting cavities.

The power converters for the pretzel sextupoles were replaced with 55A bi-polar units to allow better control of the tune differences between electrons and positrons for pretzel operation. This should allow accumulation of higher currents at injection energy and permit more accurate tuning for physics in collision.

A new set of beam loss monitors were installed at the location of 38 collimators. These monitors will permit the identification of beam losses around the LEP azimuth and allow faster, more accurate setting of the collimators around the beam tails.

Following the excellent results of the complete vertical re-alignment in the previous shutdown, a similar exercise was repeated this year. In fact the accuracy of the re-alignment was improved with respect to the 92/93 shutdown.

The shutdown officially ended for the main tunnel on the 15 April in order to perform the INB safety inspection on the following day. Following this successful INB test a "cold check-out" was performed (in parallel with access to L3) during the following week. This cold check-out was once again shown to be invaluable for debugging all the LEP equipment before the arrival of the beams.

The LEP tunnel was closed on Sunday 24 April and a beam was circulated only a few hours later. The next two weeks were foreseen for the LEP start-up with beam. In reality the first pilot physics run was performed about 4 days ahead of the planned date. The carefully planned sequence of tests and measurements aimed at progressively covering all phases of operation from single beam injection at 20 GeV to pretzel operation with 8 bunches per beam colliding at 46 GeV with a tightly squeezed, was carried out during the first 10 days of re-commissioning. The following few days were dedicated to fine tuning for physics data taking with moderate currents. Stable operating physics conditions were given during the second week-end of the 2 week re-commissioning period, a few days before the planned commencement of operation for physics.

LEP2 Radio-Frequency System

After three radio-frequency groups, two from SL and one from AT, had been merged at the beginning of the year, work on the radio-frequency system for LEP2 has continued with high priority.

An additional superconducting module of four niobium sheet cavities was installed during the shutdown and will be tested with beam in the first part of the run.

Attention now mainly focuses on two auxiliary components: - the couplers through which the power is fed into the cavity (power couplers) - and the couplers which remove the undesirable higher-order modes from it (HOM

couplers). Major difficulties were experienced with the power couplers in the second half of last year and significant modifications to their design have therefore become necessary. A first series of new couplers into which all required improvements will have been incorporated, will be tested by September of this year.

Around 20% of the higher-order mode couplers have shown a tendency to quench at high fields. Several different measures, such as pulsed processing will be studied with the aim to cure this problem.

After some initial difficulties, cavity production in industry now proceeds at an acceptable rate and is considered not to be a bottleneck anymore.

Linear Collider Studies

The studies in the framework of an International Collaboration on R&D for Linear Colliders operating at 30 GHz (CLIC) have been continued concentrating on certain beam dynamics aspects and on technological developments.

A realistic implementation of the focusing scaling with energy, based on a division of the linac into sectors has been worked out. A first design of the two-stage bunch compressor giving the 0.17 mm bunch required, and including bunch shaping that favours small energy spread has been developed. Tolerances for the uncorrelated jitter of the element positions and excitation currents have been worked out.

Gradient tests at high power of a 33 GHz acceleration section have been carried on (at MIT). Two 30 GHz acceleration section prototypes have been ordered from industry. Two beam position monitors (33 GHz cylindrical resonant cavities) have been fabricated, one being presently tested in the CLIC Test Facility (CTF). A 30 GHz structure for power transfer has been built for future tests in the CTF. Mode converters for power-pulse compressors are undergoing RF and vacuum tests.

TECHNICAL SUPPORT DIVISION (ST)

During the first six months civil engineering activities were very visible on the Meyrin Site. Construction work has started on the Physicists Building, the new Hostel and the rebuild of the SC area.

This latter undertaking was made possible by a generous donation of the Geneva Authorities and in whose presence a ceremony was held on April 12th to celebrate the beginning of construction work on the old site of the synchro-cyclotron.

In the same area of the site, the renovation and extension work of Restaurant 1 is making steady progress and at the beginning of June the modernized installation should be in full operation.

In a more withdrawn corner of the Meyrin site the transformation work for the Heavy Ion Linac has been completed and handed over to the linac assembly team.

At the end of 1993 and the beginning of 1994 further irruptions of sand and clay into the LEP Tunnel between points 3 and 4 have again drawn the attention to the need to find a solution to this problem. Indeed a preselection of engineering firms has taken place and there will be a call for proposals of how to remedy the present situation. With the assistance of outside experts a final choice will have to be made amongst the presented ideas.

The LHC experiments ATLAS and CMS have submitted numerous questions with respect to possible lay-outs of the respective experimental halls and tentative designs have been proposed and cost estimates established.

The Transport and Handling Group has by now completed the setting up of the new operation system of the car fleet at CERN. In short the system can best be described to work in full analogy with a private car rental system where full costs are worked out by the Group and paid for by all the customers. Thus the system is fully self-supporting and its operation is monitored by the users.

The Electrical Installation Group has completed the cable installations and electrical distribution facilities for the LEP200 Project. The Group is now turning its attention to the refurbishing of the electrical distribution network on the Meyrin Site, where in particular the sectors in the PS area have reached a venerable age and are no longer satisfying neither safety conditions nor remote control and monitoring needs. There is a greater and greater need to modernize the installations so as to also save man-power wherever possible.

Cooling and Ventilation is very concerned with the ever growing requests for more cooling on the many sites when at the same time the supply capacity of cooling water from the lake of Geneva and the sources located in the plain of the Rhône river is exceeded by the demands. New closed circuit cooling will have to be introduced on the many facilities which at the present time still make use of rather primitive and wasteful systems.

The ban on CFC in the cooling systems is becoming effective at the end of 1994 and plans have to be drawn up to permit a change-over to the new type of refrigerant.

The Monitoring and Controls Group is undertaking a complete renovation of the SPS Access Control System which has reached the venerable age of 20 years, during which many electronic revolutions have taken place and which must now be introduced to maintain the required high level of reliability and permit ease of maintenance.

Last but not least the Site Maintenance Service is trying to keep the ever increasing sites in good shape and the Laboratories in clean condition. This task is becoming more and more difficult with budgets under steady erosion and tasks increasing in number and size.

TECHNICAL INSPECTION AND SAFETY COMMISSION (TIS)

The shutdown at the beginning of the year was used to complete the installation of the radiation monitor systems for induced radioactivity (new amplifiers) and the environment (differential chambers for air measurements) of the neutrino cave and the NAHIF area. The preparation of the SPS North and West halls for the experiments with lead ions later in the year has started. Due to the expected high neutron levels, the shielding configurations must be improved, in particular by covering the beam lines with concrete blocks. In anticipation of the expected higher radiation levels, a new instrument for the routine measurement of stray fields based on a tissue equivalent proportional counter was acquired and tested. To safeguard against the removal of radioactive items from the CERN sites, 10 monitors for the measurement of induced radioactivity were bought and the planning started for their installation at all the access points to the SPS and the two main entrances of the Meyrin site.

The work safety inspections concentrated on areas which are only accessible during the annual shutdown of the accelerators. The alarm systems and safety installations of the four LEP experiments and the CHORUS and NOMAD experiments at the SPS have been thoroughly tested. Meanwhile, the installation of cryogenics equipment for the LEP 200 programme required continuous interventions. The prototype dipole magnets for LHC under construction at various manufacturers have also been followed closely.

The programme of the replacement of electrical equipment containing PCB (Polychlorinated-biphenyls) follows its course. The drains and sumps for surface water from the SC area, which is now free of equipment with PCB, have been cleaned. The construction of the new building for physicists and the new hostel are closely followed to ensure that the fire safety requirements, in particular concerning the use of plastic materials, are according to CERN safety rules. The programme in collaboration with the Atomic Institute of the University of Vienna for irradiation and testing at liquid nitrogen temperature of some selected organic materials for the LHC machine is advancing well. The main safety topics addressed for the LHC experiments are liquid argon calorimetry and the calorimeters in the forward regions which are exposed to intense radiation from the crossing point.

Dès le début de l'année 1994 le Service Médical a repris les visites médicales avec les modalités définies en octobre 1993, c'est-à-dire en essayant d'y associer les examens complémentaires (radiographie, contrôle ECG du coeur, test de la fonction respiratoire, contrôle de l'audition) pour éviter la multiplication des déplacements du personnel. Cette manière de faire s'inscrit dans le projet de proposer à l'ensemble du personnel au minimum une visite médicale tous les deux ans, réservant la visite annuelle au seul personnel astreint par son travail soit à des horaires alternés, soit à des nuisances spéciales, notamment au personnel ayant accumulé une dose radiations "carrière" supérieure à 100 mSv.

Le Groupe Secours et Feu a dû traiter quelques incidents bien maîtrisés sortant de l'ordinaire, c.à.d. un incident chimique, un incendie criminel et un incendie dans le tunnel du LEP lors d'un étuvage. Le programme de mise à niveau et de renouvellement permanent des équipements de secours se poursuit. Le 2ème véhicule de lutte contre l'incendie est en cours de montage avec livraison prévue en juin et la commande pour le remplacement de l'ensemble des appareils professionnels de protection respiratoire est imminente.

III ADMINISTRATION

- Director-General Unit (DG)
- Directorate Services Unit (DSU)
- Administrative Support Division (AS)
- Finance Division (FI)
- Personnel Division (PE)

DIRECTOR-GENERAL UNIT (DG)

Since 1st January 1994, this unit consists solely of the Director-General and the Directors.

All the various activities conducted under the direct authority of the Director-General, as well as the activities, which until the end of 1993 had belonged to the General Administration Division (AG), have been grouped for administrative purposes in the newly created Directorate Services Unit (DSU).

DIRECTORATE

The Directorate meets weekly. Its deliberations are confidential, but summaries of decisions are distributed to Division Leaders and the President of the Staff Association.

DIRECTORATE SERVICES UNIT (DSU)

Activities conducted under the direct authority of the Director-General, and those, which until the end of 1993 had belonged to the General Administration Division (AG), have been grouped for administrative purposes in this newly-created Unit. The Head of the DSU is responsible for all administrative and logistic matters pertaining to the groups within the DSU, although for the carrying out of their duties, the group leaders and individual staff members report to the Director-General or one of the Directors as appropriate.

OFFICE OF THE DIRECTOR-GENERAL

Relations with Member States

A unit has been established within the Office of the Director-General to monitor CERN's relations with its Member States. It gathers relevant information on HEP in Member States and on the diplomatic aspects of their relations with CERN, and makes this information available to the CERN Management in the form of timely reports and of a regularly updated database. This unit also serves as a contact-point for the CERN Delegates and helps organize visits to CERN of high-level representatives (scientific and governmental) from Member States and other countries.

Two special committees have been set up by this unit: one - to centralize information on practical questions related to the Host States, and to organize regular consultation at senior level between CERN and the Host States' administrative services on all matters of joint interest; the second - to coordinate and promote internal concertation on CERN's external relations in the broadest sense.

COUNCIL SECRETARIAT

For the first half of the year, the Council Secretariat continued in its task as Secretariat to the Council of the Organization and its subordinate bodies (Scientific Policy Committee, Finance Committee and Committee of Council); involving not only the preparation and circulation of information and documents for the discussions and seeing to the needs of the President, the

various Chairman and the Delegates, but also making the practical arrangements for the meetings themselves.

The Secretariat also dealt, in the same way, with the meetings of the recently-created Tripartite Group on Remuneration and Employment Conditions and continued to prepare the meetings of Restricted and Plenary ECFA.

DIRECTORS' OFFICE

Industrial Services Unit

In 1993 there were a number of major changes in the activities of the Industrial Services Unit. The scope of activity for the Industrial Services Unit was extended from the limited Industrial Support (Service, General Maintenance and Temporary Labour Contracts) to also include contracts for Work and Minor Work, Computer Maintenance, as well as rental and leasing contracts. The accounts for the year now reflect this change of definition. The unit was strengthened by the appointment of an Industrial Services Manager who took up the appointment at the beginning of March.

The Unit contributed during the year to the work of the Fiumi Working Group on Purchasing Policy and Procedures with two members attending the meetings in their capacity as experts.

Following the Finance Committee meeting in October, work has started on a review of all Industrial Services Contracts. This work is coordinated by the Industrial Services Unit through the Industrial Services Committee, which contains representatives of all CERN Divisions who use industrial services.

Relations avec les Etats-hôtes

Au titre des relations avec les Etats-hôtes, l'Administration a poursuivi sa mission de représentation de l'Organisation auprès des autorités administratives françaises et suisses à tous les niveaux. Elle s'est occupée plus particulièrement des questions suivantes: séjour et emploi des conjoints et enfants des membres du personnel, passage par le tunnel intersites et par la frontière, arrangements avec les douanes et les polices, plaintes lors de vols, transport et circulation, statut des entreprises contractantes et de leur personnel ainsi que de procédures administratives diverses.

Industry and Technology Liaison Office

The main activities of the Office have been related to various aspects of the implementation of the new purchasing policy :

- participation to the Monitoring Board, set up to implement this policy,
- information for CERN staff,
- relations with Industrial Liaison Officers and follow up,
- preparation and drafting of collaboration agreements,
- issues related to various aspects of Technology Transfer (licensing, protection of CERN intellectual property rights, policy relative to CERN software,...).

The Office has also been involved

- in the identification and information concerning technological spin-off resulting from CERN activities, (applications of particle accelerators,...),
- in the relations with the European Union (negotiation of a cooperation agreement),
- in the usual relations with the Member States industry in view of the LHC project.

Planification divisionnaire

Chargé de la préparation du plan à long et moyen termes, du budget et de son exécution pour le Secteur de l'administration et des unités DG et DSU, le bureau, outre des tâches factuelles pour le Directeur de l'administration, a pris une part active aux travaux de divers comités et groupes de travail.

Le bureau a par ailleurs mené à bien l'introduction de Electronic Date Handling (EDH) au sein des services de la Direction générale.

SERVICE JURIDIQUE

Le Service juridique a rempli sa fonction de conseil de l'Organisation. Il a participé à l'élaboration des décisions relatives au LHC, aux discussions relatives aux contributions de certains Etats Membres, à l'élaboration d'accords de coopération avec des Etats non Membres de l'Organisation ainsi qu'entre le CERN et l'Union européenne.

Il a pris part aux travaux de la Caisse de Pensions de l'Organisation, en ce qui concerne notamment la garantie des pensions en cas de dissolution de l'Organisation et les questions juridiques liées à la gestion de ses biens et à la mise en place des procédures de concertation avec les Etats-hôtes.

Il a participé à plusieurs Comités internes (notamment le Comité pour la Politique de Sécurité, le Groupe des Pensions, le Comité pour la Formation) et Groupes de travail (révision des Statut et Règlement du Personnel).

Il a suivi les dossiers relatifs à la prise de brevets et aux accords de coopération avec des Laboratoires de recherche.

Sur le plan du contentieux, il a défendu les intérêts de l'Organisation, notamment en matière de recours de membres du personnel devant le Tribunal administratif de l'OIT, a poursuivi sa tâche dans le domaine des assurances, contribué au règlement de dossiers commerciaux litigieux. Il a assuré la défense de l'Organisation dans l'arbitrage SGIS/CERN. Il a conduit le dossier de l'arbitrage EIFFAGE et Consorts/CERN et contribué au règlement amiable du différend CERN/GTM.

AUDIT INTERNE

Au cours du premier semestre de l'année le Service d'Audit interne a concentré ses efforts sur la révision des Comptes 1993 de l'Organisation et de la Caisse de Pensions. Les travaux se sont déroulés selon un programme de contrôles et vérifications convenu avec les Commissaires aux Comptes. Cette préparation des travaux et les discussions qui suivent la révision des Comptes permettent d'éviter les duplications d'efforts.

D'autre part, un certain nombre d'autres enquêtes et études ont été menées à bien dans différents secteurs de l'Administration. L'Audit interne apporte régulièrement sa contribution à la mise en place de procédures nouvelles ou à des améliorations et adaptations.

STRATEGIC PLANNING UNIT

The Strategic Planning Unit (SPU), continued helping the Management in the medium and long-term planning activities. The main task has been in preparing the LHC-documents submitted to the CERN Council and its

committees in March, April and later during the year. The related tasks have included in-depth simulation of possible different human resources and materials resources and funding strategies. SPU has also participated in the Budget and Planning Related Issues (BPRI) Working Group and contributed to its studies.

In addition, SPU developed a number of miscellaneous tasks requested by the Management including: analysis of economic parameters in the Member States, cost assessment (e.g. user costs) and cost simulation (e.g. recruitments).

SPU has also provided support to the "Bureau de Liaison Industrie et Technologie" (BLIT) in terms of arranging industry visits on site and establishing contacts between the interested companies and CERN-engineers.

SPU is collaborating with external Business Management Institutes and participates in joint studies. These include subjects such as project management, farming out, human resources management and purchasing strategies.

COMMUNICATION AND PUBLIC EDUCATION UNIT

The *Communication & Public Education Group* continued to play its role of looking after the public image of the Laboratory. The Group structure was rationalized in February under a new Group Leader and now has its 30 staff members in four Sections.

The *Media & Publications Section* contains the Press Office, the former Communications Section (Weekly Bulletin, Annual Report and documentation for visitors), the CERN Courier and the Photo Laboratory. The first half of 1994 has been busy, notably with preparation of the Annual Report, increased contacts with the media in preparation for a decision on the LHC, and the re-organization of the Photo Laboratory.

Visits & Reception: the Visits service inherited the Reception from AS Division in January. The Section played its usual vital role of showing CERN to VIPs and the general public. Figures for the first quarter show we are on target for receiving 25 000 visitors by the end of the year.

Microcosm and the Exhibitions team were merged in January 1994. Microcosm was inaugurated in September 1993 and now receives about 1000 visitors per week. Technical backup and small repairs are supplied by two audio-visual technicians. The souvenir shop with videotapes, posters and diskettes on particle physics will soon be merged with the Reception desk sales operation. Overall operation of Microcosm is running smoothly; since opening in 1989, there have been over 100 000 visitors, many of whom, mostly schools, want to come back; permanent links with local schools are being developed.

The 1994 exhibition program includes Budapest in February, a joint venture from April to June with ESO in Lisbon – the main project this year – and a few smaller exhibitions at the EPAC conference in London (June), the Ecole Polytechnique bicentenary in Paris (October); NIKHEF Amsterdam (October) and Trento (November). The Lisbon exhibition is a prototype for the European Travelling Science Expo, which from 1995 will visit cities including Berlin and Stockholm; Microcosm has created specialized itinerant exhibitions in the past, such as Fusion 93 which is still touring Europe under the auspices of Euratom.

The Admin. & Planning Section assists the Group Leader in the day-to-day budget and personnel planning of the Group. Activities in the first quarter concentrated on implementing the new Group structure and centralizing much of the routine administration which used to be performed at Section level. The Section was closely involved in planning and running two weekend courses in February and March at CERN "Quarks in the Curriculum" for teachers from Finland and Hungary (47 participants) and from Denmark and the United Kingdom (49 participants) – the encouraging feedback showed the relevance of such courses in taking modern physics into the classroom and stimulating an interest in particle physics among the young; planning for the next course in October for teachers from Germany and the Czech Republic is under way.

CERN PENSION FUND

The Annual Report of the CERN Pension Fund (CERN/2042-CERN/FC/3702) is submitted to Council separately.

ADMINISTRATIVE SUPPORT DIVISION (AS)

Data-Base Applications:

All resources, not allocated to maintenance and support, were used for the continuation of the AIS project.

In the Human Resources Management and Payroll area, a commercial package was acquired in late 1993, and a major effort is currently invested in its parametrization. As far as the Payroll Management is concerned, a package totally integrated with the former, is being evaluated.

For Materials Management and Logistics, a commercial package is in the process of being acquired.

In the Import-Export area, a commercial package totally integrated with the Purchasing System was acquired and is now being implemented.

A new application for Advance and Claims is currently being developed in-house, in view of CERN particularities.

Desktop Computing:

The Desktop Computing group consolidated its service role by integrating the ECP/PPE Mac technical support and preparing the taking over of the DG Macintosh support, thus now providing Macintosh as well as PC support for the whole of CERN. Update license agreements for standard PC and Macintosh software were negotiated.

Document Handling

The group continued to operate the CERN Printshop. The Desktop Publishing centres continue to operate with the DTP in Bdg 2 recently installed in newly refurbished office space.

An OCR (Optical Character Recognition) service was started in Bdg 510. This allows users to scan pages of text and convert them into word processing files.

A FileMaker based system for the tracking of mail in the DG's Office was designed and implemented.

The scanning equipment for the CERN preprint server was moved to the printshop. The service was opened on 1/4/94 and allows physicists to view HEP preprints from their desktop computers using World Wide Web (WWW).

General Services

Measures are being taken to provide informatics support from a central source for the Space Management database (GESLOC) and the Mail Office.

Contacts with the Swiss and French postal authorities have been strengthened.

After reinforcing the frequency and efficiency of controls of persons and vehicles entering or leaving the CERN sites, further measures to improve the security of people and goods are being examined.

Work on the new on-site hostel is progressing according to schedule.

Logistics

Following the software package analysis carried out in 1993, the Materials Management package which had the best functional fit was installed on-site and evaluation tests have been carried out. Testing is continuing and customizing and implementation are planned for the autumn of 1994.

The implementation of the MML package will have a major impact on Stores operations. In principle the inventory in all stores will be managed individually, currently they are managed globally, and bar coding and electronic point of sale techniques are under consideration as part of the modernization plan to be implemented at the same time as the MML package.

In inventory management, new forecasting techniques and stock optimization tools are under consideration.

The SIRIAC Purchasing and Logistics applications in the project will be completed with the addition of a SIRIAC Import-Export module. Development commenced in October 1993 and the target date for implementation is June 1994.

Following the successful experience gained from the setting up of an electronic tariff for air freight shipments outbound from CERN, the tariff with shipping costs for inbound air freight shipments will be introduced at the same time as the above application. The long term objective remains to introduce a "Pull" strategy in inbound logistics based on "Ex-Works" terms, which would be in harmony with the new Purchasing Rules which came into effect in January 1994.

Organisation & Procedures

The mandate of the Organisation and Procedures Service has been redefined and agreed with the Comité de Liaison Administrative (CLA). At the same time, the role of the 'Groupe de Travail sur les Procédures Administratives' (GTPA) and its relation with the OP Service has been defined. The GTPA is a working group

with representation from all divisions charged with the production of a procedures manual. Members of the Service are heavily involved in this work and the preparation of the manual is progressing.

The Service is actively collaborating with the team charged with the implementation of the new Human Resources Management and Payroll system. Their role in this context centres on user support and will include documentation of procedures and working methods. The database of institutes used by PE Division and the Users' Office has been tidied up and completed.

The OM Section continues to provide the secretariat for the CLA.

Scientific Information:

The major event was the opening in early April of the service for full-text access on the WWW to practically all preprints in the areas covered by the Preprints database. The data are partly files obtained from bulletin boards and processed at CERN, partly scanned images of printed material. A technique for semi-automated cataloguing of bulletin board items was developed, which results in staff savings and improved means for international co-operation on job sharing. A few remaining implementations of important existing modules in the library system are being handled by vendor support. A number of large databases are now mounted as networked CD-ROMs, including INSPEC (Physics Abstracts), and Engineering Index Page-1. IS developments are in most cases the result of joint efforts with the new Informatics Support organization (AS-DH Group)

Systems and Interfaces Unit

The Silicon Graphics platform for the Financial and Purchasing systems has been replaced by a new SUN SPARC 1000 server. A new SPARC 1000 machine for the Human Resources application was installed. All CERN QuickMail servers were concentrated in the AS server room in building 5, to permit easier operation and maintenance of the entire mail system (1300 users on 7 servers).

For BHT, we have put effort into the 1993 bookclosing and we have included support for pluri-annual cost centre structures in BHT. The extraction mechanism has been modified to deal with the new means of budget allocation. BHT and Accounting courses have been continued in conjunction with FI Division, and a BHT paper was presented at the European Oracle User Forum 94 in Maastricht.

EDH now fully supports the creation, authorisation and transfer of DAI's and TID's. As from version 1.3.2 (released in March), a document can be forwarded

to other people for signature (or for information). EDH 2.0 is under development and will go into production as from end of May, this version will contain support for the Shipping Request document.

EDH is now in use in all divisions, and the total number of people using EDH adds up to over 1200, although PPE and AT usage has only recently begun.

The migration and re engineering of our EDI applications on new hardware and software platforms has been implemented. A high level specification has been produced of a gateway environment necessary for the expansion of the EDI services at CERN.

Translation and Minutes: The Translation and Minutes Service carried out its normal tasks of translation work and minute writing, not only for the Council and its Committees, but also for the Standing Concertation Committee, the Governing Board of the Pension Fund and the Investment Committee. The service provided support to the tripartite group on the remuneration and employment conditions of CERN staff. Translations were mainly among the two official languages but texts for translation into and out of German, Dutch and Russian were also received.

FINANCE DIVISION (FI)

1.— INTRODUCTION

Recommendations for a revised purchasing policy including new adjudication rules, improved tendering procedures and balanced industrial returns to Member States with a proposal for corresponding amendments to the Financial Rules, and recommendations for a technology transfer policy were presented to the Finance Committee and Council in December 1993 (CERN/FC/3662 - CERN/2006). Approval was unanimously recommended by the Finance Committee. The content of the document was unanimously approved by Council on 17 December 1993 for implementation as from January 1994 with an initial three year-trial period.

A number of presentations were made to all Divisions and Groups throughout the Organization during the first two months of the year to explain the new rules and procedures associated with the implementation of the above-mentioned recommendations.

A further important item during this period is the work associated with the audit of the 1993 Annual Accounts by the Norwegian Auditors and with the corresponding reports to the Finance Committee and Council in preparation for the June meetings.

2.— FINANCIAL AND ACCOUNTING SERVICES

In the first few months of 1994, the activity of Financial and Accounting Services has been centred particularly on the annual book-closing routine for 1993 in addition to the regular work for the current year.

A new computer was installed in March 1993 and the performance has been significantly increased. The installation of new versions of the Sircac and Oriac products, running under Oracle Forms 3, is scheduled for May 1994. This will give a more user-friendly interface as well as new functions.

In parallel, studies for the implementation of a new electronic payment system have been continued. The system has to be fully tested to be in production in the course of the second part of the year.

Furthermore, thorough analyses of all aspects of our pay-roll, advances and claims systems are being conducted in association with ADP with a view to acquiring more modern software compatible with the requirements of the AIS project.

3.— PURCHASING SERVICE

There was an increase in activity during the period under review. During the first few months of the year 28 contracts were awarded, 11 calls for tenders sent out and a total of about 6,500 orders placed. Furthermore, in accordance with the new purchasing procedures approved by Council, 14 market surveys were launched. Contacts were also increased with Industrial Liaison Officers appointed by their respective Member States who now receive the forthcoming call for tenders documents, the market surveys, the calls for tenders and the regular reporting documents.

A total of 17 one-day exhibitions have so far taken place and to date a further 2 are planned for the near future.

A series of presentations were held concerning the new purchasing procedures and a regular seminar is in preparation as part of the Technical Seminars.

4.— BUDGET, FINANCIAL PLANNING AND STATISTICS GROUP

This Service prepares the Organization's Budget documents as well as the official documents on the contributions of the Member States and on the cost-variation index for Personnel and Materials and also contributes to the financial part of the Organization's planning documents. It is particularly involved in the financial aspects of long-term manpower planning. The basic concept of sectoral complements was worked out in this Service.

With a view to long-term staff planning, a modified version of the simulation model for the Personnel Budget, covering 15 years instead of 10, is being prepared.

As from 1 April 1994, the Service is also responsible for the suppliers data base and for updating the statistics in connection with the return coefficients of Member States.

PERSONNEL DIVISION (PE)

The periodic review of the Staff Rules and Regulations continued in collaboration with representatives of the various sectors of the Organization and of the Staff Association. This has led to the preparation of documents on major issues for discussion in-house prior to presentation to the Finance Committee and Council.

Several members of Personnel Division have participated this year in the testing of a new Human Resources and Payroll computer software package which it is planned to implement in the near future. This has also involved the organisation of training for end-users in various services of the Division.

Having completed the annual Training Plan for 1994, the Joint Training Board has started work on a five-year forward look into training at CERN, to be submitted to the Director-General in autumn 1994. The impact of the new purchasing policy on training needs at CERN was studied and a number of actions set in motion; these include communication of the necessary information, specific training in the details of the policy for staff directly concerned in placing orders, and relevant language training. In addition, there was a considerable increase in the demand for team building actions at various levels within the Laboratory.

The reorganisation of Personnel Division, starting in January, was progressively implemented in the first half of 1994. The main change involved the regrouping of similar activities concerning the various types of members of the personnel into two units: Human Resources Services and Administrative Services.

Further to the Management's decision, in October 1993, to introduce - on a trial basis - the possibility of part-time work as a pre-retirement measure, some 40 enquiries have been made by staff members aged 55 and above. The application of this measure is valid until end 1994 when it will be reviewed taking account of the requirements of the Organization.

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