

Last month at CERN

30th Session of Council

On the afternoon of 16 June and the morning of 17 June, delegates from the 13 Member States of CERN met for the 30th Session of the CERN Council, under their President, Mr. J. H. Bannier (Netherlands). Two of the most eagerly awaited decisions are reported on the previous page, further details of the Council Session will be given in next month's issue of *CERN COURIER*.

PS operation, 19 April–31 May

The first two weeks after the short Easter shut-down at the proton synchrotron were devoted mainly to counter experiments, the accelerator parameters during most of the time being the typical ones of maximum proton momentum 19.2 GeV/c, one pulse every 2.3 seconds and flat-top duration (when protons circulate in the accelerator at constant momentum) 300 milliseconds. For three days over the second week-end, however, the primary beam energy was lowered to 9.97 GeV/c, with a repetition rate of one pulse every 1.2 second and a flat-top of 200 milliseconds, in order to carry out some important measurements on proton-proton scattering.

Among the experiments previously mentioned in these columns of *CERN COURIER*, the group aiming to measure the parity of the xi-hyperon successfully collected more data, the missing-mass-spectrometer group investigated three overlapping regions of the mass spectrum in their systematic search for possible new meson resonances, and 50 000 more photographs were taken by the physicists investigating the decay of the rho meson. The 'CERN/lvry group' took some 200 000 photographs of kaons and pions scattered directly backwards from hydrogen. Several hundred thousand photographs of particle tracks in the six conventional spark chambers that have provided the main data for this experiment will be analysed automatically with the aid of the cathode-ray-tube flying-spot digitizer, Luciole, at CERN. Apart from the measurement of proton-proton scattering at low energy mentioned above, measurements of proton-nucleus scattering were made, with a proton

momentum of 19 GeV/c, about 110 000 events being recorded by the sonic-spark-chamber and computer combination.

Also during this time, new equipment for future experiments was tested by various groups, among them one from Frascati, which measured the background of a neutron telescope (apparatus for detecting neutrons travelling along a specific path) and tried out time-of-flight equipment to be used in a forthcoming investigation of the decay of the eta meson into a neutral pion and a gamma ray. Tests were carried out on the CERN heavy-liquid bubble chamber in preparation for the antineutrino run that began in the following week.

Antineutrino run

The three weeks 7–31 May were used mainly for an experiment with the 'neutrino beam' and the enlarged CERN heavy-liquid bubble chamber, to complete the present phase of the neutrino experiments begun at CERN in July 1963. During the first part of this last run, the fast beam-ejection equipment was used to eject 17 proton bunches on to the external target in the throat of the magnetic horn at each accelerator pulse. The remaining 3 bunches circulated during the 'flat-top' and were then directed on to target no. 60, by means of the rapid beam deflector, to give a 200 μ s burst for the British bubble chamber at the end of the o_2 beam line. For the last few days, the whole of the circulating beam was ejected on to the neutrino target.

Altogether 2.3×10^{17} (230 thousand million million) protons struck this target during actual operation of the bubble chamber. Of these, 91% were used to give pictures for analysis; the rest were accounted for by the study of the neutrino-parent spectrum (that is, of the energy distribution of the pions and kaons produced in the target and decaying to give neutrinos) and adjustment of the chamber. Although this was largely an experiment with antineutrinos, produced in the decay of negatively charged pions and kaons, the magnetic horn was set to focus positive particles during part

of the time (during which 14.2% of the total number of protons were utilized), the particle flux in the bubble chamber then being predominantly of neutrinos. The data so obtained will be used for a comparison of the antineutrino and neutrino event rates.

The first scanning of the 367 000 bubble-chamber photographs was made during the run, resulting in about 100 candidates of each type of interaction, of which about half are suitable for detailed analysis. As an indication of how techniques have been improved, this may be compared with the first run of 6 days in 1963 using the smaller version of the bubble chamber, when only a dozen events were obtained in spite of a higher proton intensity on the target. Part of the increase in event rate is, of course, due to the enlargement of the visible volume (that viewed by at least two cameras) of the bubble chamber from about 440 litres to 1090 litres. The final analysis of the events and comparison with previous observations will continue into next year.

A valuable technical by-product of the run has been the development and installation of a freely suspended rigid plate in front of the plastic membrane that expands the chamber. This plate changes the pattern of the pressure distribution in the chamber during the operating cycle, so that the hydrodynamic behaviour of the bulk of the liquid is much closer to that obtainable with a large piston than to that around a gas bubble, as was the case previously. The presence of such a plate has been found to improve the optical quality of the pictures, and its success opens up the possibility of further developments for the chamber, such as the installation of Scotchlite reflector* or the mounting of a mirror on the plate. If a mirror were installed in this way, a proposed bubble-chamber experiment on the decay of the K^0_2 meson into two neutral pions would become feasible, since it would then be possible to photograph and measure phenomena that occurred on the other side of the

* Scotchlite is the Trade name of a highly reflecting plastic film, used for example on many road signs; its use in a bubble chamber results in tracks that are seen as trails of dark spots on a light background, instead of the other way round.

vacuum chamber that would have to be inserted in the bubble chamber for the traversal of the kaons.

Last experiment at CERN of the British bubble chamber

During week 18 of the synchrotron schedule (beginning 27 April) the 152-cm British national hydrogen bubble chamber took 110 000 photographs of 6-GeV/c proton interactions in hydrogen. Then, in weeks 20 and 21, 135 000 photographs were obtained of negative pions incident at 11 GeV/c, as part of an experiment in which the interactions of both negative and positive pions are being studied at this momentum. This last run ended the operation of the chamber at CERN for physics experiments. It has been in full operation since June 1964, since when more than $1\frac{1}{2}$ million photographs have been obtained. The chamber will not be returning to England until September of this year and in the meantime a 'technical' run will be carried out in which various new ideas, for example the use of a Scotchlite optical system, will be tried.

Purdue conference on instrumentation for high-energy physics

Seven members of CERN — R. Böck, G. von Dardel, A. N. Diddens, G. R. Macleod, A. Micheleni, W. G. Moorhead and D. Wiskott — attended the International conference on instrumentation for high-energy physics, held at Purdue University, Indiana, during 12–14 May, 1965. This was the largest instrumentation conference since the one held at CERN in 1962, not excepting the one following the 'Rochester' Conference at Dubna last year, and was organized largely on the initiative of Prof. L. Kowarski, who has been on leave from CERN as Visiting Professor of Nuclear Engineering at Purdue.

A series of invited survey talks and contributed papers covered the field of spark chambers and bubble chambers and the measuring devices and methods of analysis used with them. The main impression gained from the conference was that, at nearly all the laboratories represented, the last year or two has been spent in consolidation and obtaining physics

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'Humanisme Scientifique'

In last month's CERN COURIER, two aspects of the relationship between 'CERN' and 'Geneva' were treated at some length (pp. 85-89), with emphasis on the more practical and personal viewpoints. Unknown to us when those contributions were being prepared, a further example was to appear in the form of an editorial in the April/May issue of the publication Industries Atomiques (vol. 3/4, 1965, p. 51). This editorial, inspired by one of the periodic evening lecture meetings arranged by the CERN Staff Association, throws an interesting light on an aspect of CERN that is not often discussed, and we are therefore pleased to be able to reproduce it (in translation) here. Extra interest is given by the fact that its author, Mr. André Chavanne, is one of the seven members of the Executive body of the State of Geneva (the 'Conseil d'Etat') with responsibility for the Department of Education. As a physicist, he taught at one time in the 'Ecole supérieure technique' in Geneva and he is a former editor of Industries Atomiques. On the Federal level, he is a member of the recently formed Science Council and also represents Switzerland in the Council of CERN.

Though it would pass unnoticed in a capital city, the presence of a large scientific research centre in a medium-sized town has a considerable effect on the local cultural life, which is enriched in a very special way: scientific humanism is, by its very nature, a mixture of curiosity, generosity and enterprise, even to the point of aggressiveness.

Not long ago I was present at one of the gatherings (concerts, discussions, lectures and the like) organized by CERN — or rather its staff — and open to the Geneva public. It was a discussion between Dr. Garaudy, a member of the policy committee of the French Communist party, and a member of the Dominican Order, a physicist, Father Dubarle; they were pursuing their dialogue concerning materialism and spiritualism, entered into previously in France and Belgium. Seldom have I encountered such an audience, following closely and intelligently this exchange of subtle arguments on matters very far removed from its everyday concerns.

One could see there the humanism of the future, founded on the sciences, expressed in mathematical terms, restrained, precise. This is not to deny the value of our classical humanism, based on a knowledge of languages — particularly the dead ones but also the living — and with a long tradition behind it ('are you for or against Latin?' is a typically inane question); but we must recognize how the experimental sciences, as well as the humanities of the Greek and Latin tradition, can be the basis of a truly general education. Will the most important fundamental questions of knowledge continue to be regarded solely in a historical context when they can be illumined in incomparable fashion by the up-to-date, lively considerations of mathematicians and biologists on their respective subjects? Can our only interest in psychology be through literature, when for the last century the behaviour of the human mind has been studied in the laboratory? We must get right away from the sterile opposition of science and philosophy, which is in any case a recent invention of mediocre thinkers of the last century and obviously unknown to Plato and Aristotle, Descartes and Leibnitz; was not the initial work of Kant prompted by Newton's theories?

But humanism is not just intellectualism, it is also aesthetic and ethical in nature. It would not be difficult to put forward to youthful minds, trained in the disciplines of science, a course of instruction largely devoted to the development of a liking for art through its rational study. It should also be possible to give them that extra spiritual development necessary for the command of today's infinitely powerful technical resources, by showing them how science extends the responsibilities of everyone, beyond the confines of family or nation, to embrace the whole of humanity here on our tiny planet.

A. C.

Colliding - beam error

The dangers of editorial tampering with carefully worded press releases, as well as the suspicion — often voiced — that so much is published in the scientific literature nowadays that nobody has a chance to read it all, have both been highlighted by a note that appeared in the April issue of CERN COURIER (p. 57) under the sub-heading 'World's first experiment with colliding beams'. In preparing that note, we were taken in by one of those press releases that so often hide the actual state of affairs in their enthusiasm for a particular event. As a result, when copies of the French edition of the April issue reached the Linear Accelerator Laboratory of the University of Paris, at Orsay, and the CNEN National Laboratory at Frascati near Rome, they were read with some astonishment, since the physicists clearly remembered their own experiments, carried out a year earlier at Orsay, with the storage ring known as AdA (Anello di Accumulazione), designed and built at Frascati. To help put the record straight, CERN COURIER has now been supplied with the following information:

The first measurements on interactions produced by colliding beams were carried out at Orsay, using the positron-electron storage ring, AdA, from Frascati, in April 1964. The results were published in December of the same year*.

Previously the storage of weak-intensity electron and positron beams had been successfully achieved at Frascati and AdA was then moved to Orsay in order to take advantage of the higher photon fluxes available there (gamma rays from the linear accelerator are used to produce positrons and electrons for storage in the ring). The ring was operated by a mixed Italian and French team from 1962 until early 1965.

* C. Bernardini, G. F. Corazza; G. di Guigno; J. Haissinski, P. Marin; R. Querzoli; B. Touschek: Measurement of the rate of interaction between stored electrons and positrons, *Nuovo Cimento*, vol. 34 (1964), pp. 1473-1493.

In the course of this work, beam intensities of up to 0.5 milliamperè (electrons and positrons) were stored, with lifetimes of several hours. A new fundamental limitation on the lifetimes of intense beams was then discovered and analysed (the so-called 'Touschek effect').

Interactions between the two beams were observed for the first time by detecting the single bremsstrahlung gamma ray arising from the process $e^+ + e^- \rightarrow e^+ + e^- + \gamma$. From the observed rate of interaction the cross-sectional area of the beams could be computed and this allowed a complete understanding to be obtained of the beam structures in weak-focusing positron-electron storage rings at intermediate intensities.

AdA was taken back to Frascati in March 1965.

It is true that the Press Release from which our original story was derived claimed only 'the first high-energy collisions between electrons ever achieved', leaving open the question of collisions between electrons and positrons. The Release also mentioned the operation of the Italian storage ring at Orsay. At the same time, however, announcement of the Stanford/Princeton results at a particle-accelerator conference in Washington, with its associated press publicity, seems to have produced a greater impact than the earlier publication of the Italian/French results in a normal scientific journal. It is true that the Stanford rings are bigger than the one at Frascati (there are two at Stanford, instead of one, because both beams are of electrons), the energy used is rather higher and the beams have greater intensity. Nevertheless, we deeply regret having overlooked one of the great pioneering efforts of European physicists in the field of storage rings, particularly as the Italian/French collaboration that made possible its success is yet another indication of the unity of Europe's high-energy physicists, characterized by CERN itself. Neglect of the European results would, in fact, now be doubly regrettable, in view of the recent Council decision to support the construction of proton storage rings at CERN and thus to give European scientists a great opportunity to continue leadership in this field in the coming years ●

Last month at CERN (cont.)

results from some of the many devices announced at previous conferences, rather than in inventing new instruments.

Thus, to deal only with contributions involving CERN, G. R. Macleod gave an invited paper on spark-chamber picture analysis with raster scan in which he described two experiments already completed at CERN (one measured on the Hough-Powell device

(HPD) and the other on Luciole), as well as mentioning several others under way here. Some preliminary results of a bubble-chamber experiment that is being analysed at CERN with the HPD were presented, by P. V. C. Hough of Brookhaven, in a joint survey paper with B. W. Powell of CERN, on flying-spot digitizer systems for bubble-chamber films. A paper by W. G. Moorhead described the CERN computer programme used for this analysis. The operation of the sonic spark-chamber system with on-line computer that is used at CERN

for proton-scattering experiments was described by A. N. Diddens.

The practice of attaching film-measuring instruments such as IEP and Frankenstein directly on-line to a small computer, so that instant checking can take place, is very widespread, and there are many different approaches to this, both in the U.S.A. and in Europe (including CERN). This idea is interesting as being one of the few that were not already mentioned at the 1962 CERN Conference ●