INTER-UNIVERSITY INSTITUTE FOR HIGH ENERGIES

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J. LEMONNE and J. SACTON

(December 1978).

I. INTRODUCTION.

The physicists whose names are listed below have contributed to the different activities of the laboratory during the year 1978.

U.L.B.

D. Bertrand (chercheur qualifié FNRS)

Gh. Bertrand-Coremans (Chef de travaux associé)

M. Csejthey-Barth (maître de recherche - IISN - FNRS)

M. Dewit (boursier IRSIA); aspirant FNRS since October 1978

J.J Dumont (chercheur IISN)

H. Mulkens (chercheur IISN)

J. Sacton (Professeur associé)

P. Van Binst (chercheur IISN)

P. Vilain (chercheur qualifié FNRS - IISN)

J. Wickens (chercheur IISN)

G. Wilquet (chercheur qualifié FNRS - IISN)

C. Wilquet-Vander Velde (1er Assistant)

V.U.B.

C. De Clercq (vorser IIKW)

M. Goossens (vorser IIKW)

M. Gijsen (vorser IIKW)

D. Johnson (vorser IIKW)

J. Lemonne (Gewoon Hoogleraar)

J. Meynaerts (vorser IIKW since october 1978)

P. Peeters (werkleider)

S. Tavernier (vorser IIKW)

W. Van Doninck (vorser IIKW)

G. Vanhomwegen (vorser IIKW)

F. Verbeure, E. De Wolf, F. Van Den Bogaert and M. Van Immerseel are working in close collaboration with the Institute.

Note: Since October 1977 R. Roosen is working in the IISN Counter group at CERN.

II. RESEARCH.

II.1. Neutrino Physics

II.1.1. Gargamelle at the P.S.

The analysis of the data taken in the ν CERN PS beam with Gargamelle filled with propane (~ 400.000 pictures) is now almost complete. The main results obtained this year can be summarized as follows :

(i) From a sample of 357 events fitting the reactions $\nu + p \rightarrow \mu^- + p + \pi^+$ on free protons, the average value of the cross section above 1 GeV is found to be $(0.60 \pm 0.07) \times 10^{-38}$ cm^2. The reaction is dominated (~ 95% for the full $\pi^+ p$ mass spectrum) by the production of the Δ^{++} (1232) resonance. The energy dependence of the Δ^{++} production cross section agrees with the predictions of Adler and quark models. The results on the Δ spin density matrix are in agreement with time reversal invariance.

(ii) For charged current events, in the energy range from 1 to 10 GeV, the ratio $R = \frac{\sigma(\nu + n)}{\sigma(\nu + p)}$ has been determined to be 2.08 ± 0.15 by two independent methods. One method uses the numbers of interactions occurring on free protons (3c and 2c fits) and all interactions in the same neutrino flux; the other method is based on the charge and proton multiplicity distributions, taking account of nuclear effects. Semi-inclusive proton production rates have thus also been obtained:

$$\rho_n = \frac{\sigma(\nu + n \rightarrow \mu^- + p + \ldots)}{\sigma(\nu + n \rightarrow \mu^- + \quad \ldots} = 0.70 \pm 0.02$$

$$\rho_p = \frac{\sigma(\nu + p \rightarrow \mu^- + p + \ldots)}{\sigma(\nu + p \rightarrow \mu^- + \ldots} = 0.85 \pm 0.02 \quad \text{and} \quad 0.89 \pm 0.03$$

(iii) Using the second of the above methods, the ratio $R' = \frac{\sigma(\nu + n)}{\sigma(\nu + p)}$ for neutral current interactions was found to be $0.76 \, ^{+0.15}_{-0.13} \pm 0.02$, whilst the corresponding ρ'_n and ρ'_p are $0.45 \pm 0.08 \pm 0.06$ and $0.70 \pm 0.05 \pm 0.06$, respectively

(iv) The relative cross-sections on free nucleons of the 3 one pion production

reactions by charged currents have been determined; for Nπ masses below 1.4 GeV/c^2 it was found that

$$R_1 = \frac{\sigma(\mu^- p \pi^0)}{\sigma(\mu^- p \pi^+)} = 0.32 \pm 0.09$$

$$R_2 = \frac{\sigma(\mu^- n \pi^+)}{\sigma(\mu^- p \pi^+)} = 0.71 \pm 0.14$$

The data demonstrate that an appreciable amount of I = 1/2 is present and that its contribution increases with the mass of the hadronic system.
The physicists involved in this work, in the framework of the Gargamelle Collaboration, are : M. Dewit, C. Vander Velde-Wilquet and P. Vilain.

II.1.2. Gargamelle at the SPS

(i) The beam dump experiment :

The 400 GeV extracted proton beam from the CERN SPS was dumped (3.5×10^{17} protons) onto a 2 m long copper target followed by a block of iron of length 80 cm. The experiment aimed to look for penetrating particles produced either directly in the beam interaction or by prompt decay of new particles. The dumping of the hadron cascade in the target reduced by 2000 the normal neutrino flux. Gargamelle, placed 950 m behind the target, was filled with heavy freon of 11 cm radiation length. A total of 32 interactions with a visible energy greater than 10 GeV and induced by neutral particles was found and, after corrections, classified into 18 charged current ν_μ or $\bar{\nu}_\mu$, 5.1 neutral current and 8.9 charged current ν_e or $\bar{\nu}_e$ events. No multi lepton events were identified. The definite excess of ν_e or $\bar{\nu}_e$ charged current events has been attributed to the production in the target and subsequent decay of charmed particles. In this case, it is concluded that the product of the cross section and the electronic decay branching ratio for these particles is

$$\sigma_c \times B_{c \to e^+ + \nu + \chi} = 32^{+15}_{-10} \ \mu b.$$

Those having participate in this experiment, in the frame of the Gargamelle Collaboration, are D. Bertrand, M. Dewit, J. Sacton and W. Van Doninck.

(ii) the WA15 experiment :

Some 240.000 pictures have been taken with Gargamelle filled with a freon-propane mixture of 55 cm radiation length and exposed to the SPS $\bar{\nu}$ wide-band beam. This corresponds to a total of 1.1×10^{18} protons of 330 GeV on the target. 80% of these pictures have

been double scanned for electrons resulting from the purely leptonic neutral current process $\bar{\nu}_\mu + e^- \rightarrow \bar{\nu}_\mu + e^-$. No candidate were found where, in the framework of the Salam-Weinberg model with $\sin^2 \theta_w = 0.2$, one would have expected 2 to 3 events. Scanning and identification efficiencies for electrons are studied. In parallel, about 2/3 of the pictures were scanned for all types of anti-neutrino interactions. Tests are in progress concerning the EMI performances, the measurability of high energy events (in particular, the e.m. showers) and the programs of the analysis chain. Priority will be given to a search for dimuons and $e^-\mu^+$ events as well as to the measurements of events with visible energy below 50 GeV.
Those participating to this experiment are D. Bertrand, G. Bertrand-Coremans, M. Dewit, J. Sacton and P. Vilain; the work is done in collaboration with Aachen, Bergen, Strasbourg and University College - London.

(iii) A test run with emulsion inside Gargamelle :
Searches for short lived particles (10^{-12}s to 10^{-14}s) are going along at CERN, Fermilab and Serpukhov making use of nuclear emulsion associated with different types of external detectors and exposed to neutrino beams. A test exposure has been performed in the SPS wide-band neutrino beam at CERN in which 2.4 l of emulsion were located inside Gargamelle filled with a mixture of propane and heavy freon operating at ~30 atmospheres and ~50°C. The stack was put in an aluminium box accurately mounted in a pressure vessel made of aluminium alloy (2.4 cm of thickness) maintained at atmosphere pressure and attached to the front door of the chamber. The temperature in the box was kept below 15°C. The test demonstrated that the emulsion could be maintained for 20 days in good conditions and that the introduction of the vessel had no serious disturbing effects on the quality of the Gargamelle pictures. Respectively 65.000 and 80.000 pictures were taken in the $\bar{\nu}$ and ν beams, corresponding to ~3×10^{17} and ~5×10^{17} protons on target. The expected number of CC ν interactions in the emulsion is 30 (± 20%). Preliminary results indicate that the location of the events in the emulsion is a factor 5 more accurate than in the WA17 experiment.

II.1.3. The emulsion - BEBC experiment WA17

A total of 30 l of emulsion has been exposed in front of the BEBC entrance window to the SPS ν wide-band beam during two runs corresponding to ~ 10^{18} protons on the target and yielding 206.000 BEBC pictures. To date 168.000

pictures have been scanned for events with more than 2 tracks emerging from the window and apparently converging to a point inside the emulsion. The measurements have so far yielded 342 predicted vertices in the emulsion for which there was a μ^- candidate as identified in the BEBC EMI. The search in emulsion is in progress and to date, 60 vertices have been located. Among these events, one charmed particle candidate was found in Brussels. It decays after 900 μm into three charged particles, identified as two positive and one negative hadrons interacting in BEBC, and at least one neutral particle. The combined probability that this event and the one found previously in the E247 FNAL experiment are due to nuclear interactions is 10^{-4}. The kinematic analysis of the decay shows that known decay modes of the D^+, F^+ and C_o^+ particles can be fitted and that the flight time of the observed particle ranges from 2 to 5 x 10^{-13}s irrespective of the particular decay process assumed. The expected number of charged current neutrino interactions found in the emulsion after completion of the analysis is around 200.
Gh. Bertrand-Coremans, J. Sacton, P. Vilain, J. Wickens and G. Wilquet participate in this work done in collaboration with Ankara, CERN, Dublin, U.C. London, Open University, Pisa, Rome and Torino.

II.1.4. The BEBC - TST experiment WA24

BEBC filled with an H_2/Ne mixture and equipped with an hydrogen Track Sensitive Target (TST) and its EMI has been exposed to the ν and $\bar{\nu}$ SPS wide-band beams. The concentration of the H_2/Ne mixture was 77 mole % at the beginning of the run, but had fallen to only 68 mole % at the end due to a continuous admixture of H_2. 284.000 pictures were taken with neutrinos (proton energy: 350 GeV) and 272.000 pictures were taken with antineutrinos (proton energy: 330 GeV).

(i) Search for the reaction $\bar{\nu}_\mu + e^- \rightarrow \bar{\nu}_\mu + e^-$:
58.000 $\bar{\nu}$ pictures were scanned twice for isolated electrons of energy greater than 2 GeV and making an angle with the beam axis less than 3°. One possible candidate (1 e^+) has been observed, whilst the estimated background is 0.5 ± 0.15. Taking into account the scan and identification efficiencies and all possible sources of signal loss, the following 90% C.L. upper limit for the $\bar{\nu}_\mu e^-$ scattering cross section is obtained : $\sigma(\bar{\nu}_\mu e^- \rightarrow \bar{\nu}_\mu e^-) < 3.4 \times 10^{-42} E$ (GeV) cm^2 corresponding to an upper limit for $\sin^2\theta_w$ of 0.45.
This search had been stimulated by the existence of conflicting results in the case of $\nu_\mu e^-$ scattering and the absence, at that time, of $\bar{\nu}_\mu e^-$ data.

(ii) Analysis of the TST events :

Priority has been given in the neutrino film to the scan, check and measurement of a sample of 1000 charged current events. The analysis of these events, all calibration and geometry tests having been done, will allow to precise the power of this technique in identifying channels involving π° mesons or neutrons.

The experiment is made in collaboration with Bari, Birmingham, E.P. Palaiseau, U.C. London, Rutherford and Saclay. Those participating in Brussels are D. Bertrand, J. Sacton, C. Vander Velde-Wilquet, W. Van Doninck and G. Wilquet.

II.2. Hadron Physics

II.2.1. K^-p interactions at low energy

(D. Bertrand, M. Goossens, G. Vanhomwegen and G. Wilquet - Collaboration: Birmingham, Brussels, Durham, U.C. London, Warsaw)

Low momentum (< 300 MeV/c) K^-p interactions have been studied in the RHEL-bubble chamber equipped with a TST. For interactions at rest the following branching ratios have been determined :

$$\gamma = \frac{\sigma\,(K^-p \to \Sigma^-\pi^+)}{\sigma\,(K^-p \to \Sigma^+\pi^-)} = 2.38 \pm .04$$

$$R_c = \frac{\sigma\,(K^-p \to \Sigma^-\pi^+ + \Sigma^+\pi^-)}{\sigma\,(K^-p \to Y\pi)} = .664 \pm .011$$

and

$$R_N = \frac{\sigma\,(K^-p \to \Lambda\pi^\circ)}{\sigma\,(K^-p \to ((\Lambda + \Sigma^\circ)\pi^\circ)} = .206 \pm .011$$

The energy dependence of the cross sections for the reactions :

$$K^-p \to \bar{K}^\circ n$$
$$\to \Sigma^+\pi^-$$
$$\to \Sigma^-\pi^+$$
$$\to \Sigma^\circ\pi^\circ$$
$$\to \Lambda^\circ\pi^\circ$$

has been studied for 80 < p_K < 280 MeV/c.
The results have been combined with the available world data to study various K and M-matrix models. The $\bar{K}N$ scattering amplitudes below the K^-p treshold have in particular been analyzed to study alternative interpretations of the Λ (1405) resonance.

II.2.2. K^-d experiment at 4.6 GeV/c

(C. De Clercq, D. Johnson, J. Lemonne, P. Peeters, G. Vanhomwegen and J.N. Wickens)
The following processes are currently analysed

$K^-d \to K^-d\,\pi^+\pi^-$	(1)	(~ 450 events)
$K^-n \to K^-n\,\pi^+\pi^-$	(2)	(~ 5000 events)
$K^-n \to K^-p\,\pi^-$	(3)	(~ 1500 events)

The analysis of the 4c-processes (1) and (3) is most advanced. Information on $K^-\pi^-$ elastic scattering has been obtained by applying a Chew and Low extrapolation method to process (3). Process (1) is dominated by the subchannels $K^-d \to Q^-d$ and $K^-d \to K^{*\circ}d^{*\circ}$.
A spin-density matrix element analysis of the coherent Q-production data suggests that a Deck-mechanism with pomeron exchange to the deuteron could play an important role apart from direct $Q_1(1.28) \to K\rho$ and $Q_2(1.42) \to K^*\pi$ production.

II.2.3 K^-p experiment at 6.5 GeV/c

(C. De Clercq, D.P. Johnson, J. Lemonne, P. Peeters, J. Wickens - Brussels, Argonne Kansas, Michigan SU and Tufts collaboration)
The automatic measurement on the Polly apparatus of the 4 prong and 4 prong-V data is still in progress. A total of 45000 events (~70% of the available statistics) have now been measured.
A multidimensional analysis of the 4c-process : $K^-p \to K^-p\,\pi^+\pi^-$ using 7 independent variables is being performed. By this way knowledge is gained, concerning ϕ-production, simultaneous K^*N^* (Δ^*) production, diffractive dissociation of the target nucleon into $p\,\pi^+\pi^-$, etc.
The 4 prong V°-data have been combined with the V°-data of the collaboration laboratories to extend an inclusive study of K° and Λ° production to the analysis of KK and KΛ correlations and inclusive resonance (K^*, Y^*) production.

II.2.4. The Mirabelle K^+p experiment at 32 GeV/c

(M. Barth, E. De Wolf, J.J. Dumont, M. Gijsen, S. Tavernier, M. Van Immerseel, F. Verbeure - Collaboration : IIHE, Mons, France, Soviet Union.)

All measurements on 400 K pictures are completed and the final DST is available, containing ~ 130.000 events. Studies were undertaken of the following topics:

- Λ and $\bar{\Lambda}$ polarization in K^+p and K^-p interactions.
- Gamma and neutral pion production: an inclusive cross section σ_γ = 62 ± 3 mb is observed and from the $\gamma\gamma$ spectrum a direct estimate of σ_{π^0} = 29 mb is obtained; the inclusive x and p_T spectra show that a large excess of gammas is produced at small x and at small p_T as compared with π^-.
- Semi-inclusive single dissociation of the proton and of the K^+: a new method was used to determine diffractive cross sections; the results are compatible with the factorization hypothesis.
- A "Kopylov-analysis" has been made of the like pion interference correlations, yielding a value R = 0.9 ± 0.1 fm for "radius of the pion emission volume"
- Single and double resonance production in 3 and 4 body exclusive states: all non-diffractive Q-2-B channels have been studied.

An extension of this experiment with 600 K more pictures was approved and about 180 K pictures are already taken. The scanning and measurement have started in april and should be finished in 1980.

II.2.5. K^+p interactions at 70 GeV/c

(M. Barth, C. De Clercq, M. Gijsen, D.P. Johnson, J. Lemonne, P. Peeters, F. Van Den Bogaert and E. De Wolf - Brussels, CERN, Genova, Mons, Nijmegen, Serpukhov, Tel Aviv Collaboration)

This experiment is performed at CERN in bare BEBC with an RF separated beam. A first batch of film (~40.000 pictures) taken during 1977, is still being analyzed. Preliminary results concerning topological cross-sections and inclusive π^-, K^0_S and Λ^0-productions have been reported at the 1978 Tokyo Conference. A second part of the data should be taken during 1979 in BEBC equipped with an external particle identifier (EPI).

II.2.6 The study of Λ^0 and K^0 production in $\bar{p}p$ interactions at 12 GeV/c

(D. Johnson, J. Lemonne, F. Van Den Bogaert and J.H. Wickens - Brussels, CERN, U.C. London, Mons, Orsay Collaboration)

The analysis of the data of this experiment performed at CERN in BEBC is now almost completed. New results have been published concerning a search for charmed particle production using 16.500 events with a visible V^0-decay. No enhancements are observed in the invariant mass distributions of $K^0 + n\pi$ (n = 1-5) and Λ ($\bar{\Lambda}$) + $n\pi$ (n = 1-3) in the regions of the known charmed particle

masses. Upper limits (95% C.L.) of $\sigma(D^+) < 320$ μb and $\sigma(D^\circ) < 260$ μb have been determined.

The study of inclusive particle production has been continued. Results have been published concerning the reactions

$$\bar{p}p \to K^{*}(890)\,X$$
$$\to \Sigma^{\pm}(1385)\,X$$
$$\to \bar{\Sigma}^{\mp}(1385)\,X$$
$$\to S^{*}(993)\,X$$

The data are being compared with model predictions (e.g. quark models, triple Regge models)

II.2.7. The Mirabelle $\bar{p}p$ experiment at 32 GeV/c

(M. Barth, E. De Wolf, J.J. Dumont, M. Gijsen, S. Tavernier, F. Verbeure - Brussels, Mons, France, Soviet-Union Collaboration)

The scanning and measurement of the last part of this experiment is under way. A sample of ~15000 events is available on DST. Only V° events are measured on the present part of the experiment. All remaining measurements will be made at the University of Mons and will hopefully be finished by the end of 1979. The following results were submitted to the Tokyo Conference:

- cross sections of single diffraction dissociation of the proton and of the antiproton
- cross sections of inclusive ρ and Δ^{++} production.

II.2.8. The study of prompt lepton production in $\bar{p}p$ interactions at 70 GeV/c

(E. De Wolf, J.J. Dumont, J. Lemonne, G. Vanhomwegen, F. Verbeure, J. Wickens - Brussels, Helsinki, Liverpool, Mons, Stockholm Collaboration)

The aim of the experiment is the study of prompt lepton production in antiproton-proton interactions at 70 GeV/c in BEBC equipped with a Track Sensitive Target (TST) and with the External Muon Identifier (EMI). A total of 188.000 pictures were taken (efficiency 80%) in the spring of 1978 during three 10 day periods. The beam is remarkably pure ($\gtrsim$ 95% $\bar{p}$), but the picture quality is poor due to parasitic boiling in the chamber.

On the basis of 9% of the pictures which have been scanned and partially rescanned by now, we confirm the expectation of the excellent electron detection efficiency provided by the experimental set-up, in particular after measurements. The analysis of the EMI-data in view of a study of $\mu^+\mu^-$-pair production is in progress.

The analysis of a total of 90.000 $\bar{p}$-interactions available in the entire film should make it possible to clarify the origin of the prompt electron signal at low p_T and in particular to separate e^+e^--creation from possible single $e^\pm$-production.

II.3. IIHE participation to EHS.

(S. Tavernier and F. Van Den Bogaert)

It has been possible to show the feasibility of a silica aerogel Cerenkov for a large area detector by the succesful operation of realistic prototype modules. One obtained 6.4 photoelectrons in a design with white highly reflecting difusing walls and photomultipliers of the type RCA 8854. Moreover the response over the detector is reasonably uniform. These results were recently published in Nucl. Inst. and Met. Further studies have shown that it is possible to obtain the same number of photoelectrons with a system of mirrors but with a smaller number of photomultipliers, so that we now consider this to be the most attractive approach. Two technical problems remained to be solved in order to have a pratical detector: very high quality mirrors should be produced cheaply and be made thin enough so that secondary interactions remain negligible, and the photomultipliers should be shielded from a field of $\simeq$ .1 Tesla.

For the mirrors we retained aluminised mylar of 70 μ thick. It appeared that the reflection coëfficient of some of the commercially available aluminised mylar is close to that offered by the best quality glass mirrors, and this at a price which is a few orders of magnitude lower.

The shielding of the large 5 inch photomultipliers of the strong magnetic stray field of the bubble chamber turned out to be a particularly serious challenge. Extensive theoretical calculations and a large number of measurements of models have convinced us that we have now a good solution to this problem.

It should be mentionned finally that the SPSC in its meeting of last october 31 has recommended approval of this detector for EHS.

III. SEMINARS AND LECTURES.

- The practical work for students attending the lectures of J. Lemonne and J. Sacton (3rd and 4th years physics) has been organized by the staff of the Institute as well as some optional practical work for students of the 3rd year in physics.

- P. Van Binst has given a series of lectures on "Notions pratiques d'informatique" at the Faculty of Sciences of the ULB.

- F. Verbeure has given three lectures at the KULAK (Kortrijk) on "Elementaire Deeltjes: luchtfoto van een gebied in snelle evolutie."

- J. Sacton has been invited to make the summary of the session "Weak neutral currents in neutrino interactions" at the Topical Conference on Neutrino Physics at Accelerators held in Oxford.

- J. Sacton has been invited to present a rapporteur talk (Some Experimental Manifestations of Neutral Currents in Neutrino Physics) at the International Meeting on "Frontier of Physics" held at Singapore.

- J. Sacton has been invited to present a rapporteur talk (Search for short-lived particles in nuclear emulsion exposed to accelerator beams: a short review of neutrino experiments with external detectors) at the XIX International Conference on High Energy Physics held at Tokyo.

- J. Lemonne has been invited to give seminars entitled "Inclusive V^0-production in K^-p interactions at 6.5 GeV/c" and "Coherent K^-d interactions at 4.5 GeV/c" at Universities of Warsaw and Nijmegen.

- J. Lemonne has been invited to present a talk on "Prompt lepton production in 70 GeV/c $\bar{p}p$-interactions" at the Workshop on Lepton-pair production in Hadron-Hadron collisions - Bielefeld

- F. Verbeure has been invited to give a talk at the University of Warsaw entitled "Particle Production in K^+p -interactions".

- F. Verbeure has given a talk on "Inclusive resonances production and a quark model" at the C.N.R.S. - Strasbourg.

- C. Vander Velde-Wilquet has been invited to present a talk on "Single pion production in charged current neutrino interactions" at the XIII^e Rencontres de Moriond- les Arcs.

- G. Wilquet has been invited at the University of Warsaw to implement a set of programmes concerning the low momentum K^-p experiment on their CDC computer.

- P. Van Binst has been invited at the University of Warsaw to give a seminar on "The Brussels on-line system"

- P. Van Binst has given a talk at the On-Line Conference on Pragmatic Programming and Sensible Software on "To make a system work, keep it simple"

- F. Verbeure has given an invited talk (Results on K^+p and $\bar{p}p$ reactions at 32 GeV/c) at the XIX Intern. Conference on H.E.P. held at Tokyo.
- F. Verbeure has given an invited talk (Inclusive resonance production) at the International Meeting on Frontier of Physics held at Singapore.
- In the frame of a Seminar on Elementary Particles organized by the Institute, the following lectures have been given :
  - B. Tallini (CERN Saclay) : Recent Results from the Narrow-Band ν, $\bar{\nu}$ Beam in BEBC at SPS;
  - H. Muirhead (Liverpool) : Antiproton Physics;
  - J. Sacton : Report on the Tokyo Conference : ν and e^+e^- interactions - Experimental Results;
  - F. Verbeure : Report on the Tokyo Conference - Experimental Results on Hadron Interactions.
  - H. Satz (Bielefeld) : Hadrons, multi hadron systems, and lepton pairs.

IV. COMPUTERS AND ON-LINE SYSTEMS

The computing and data handling tasks at the IIHE fall in two categories. The first one includes the on-line acquisition with the associated guidance and validity checks. These tasks run on four computers from Digital Equipment Corporation, belonging to the IIHE : one DEC system 10 mainframe, as well as two PDP-11/40 and one PDP-8/e minicomputers. The DEC-10 supports a POLLY automatic film reader and four SAAB tables with manual digitizers, and the first PDP-11 supports a SWEEPNIK automatic film reader. All these measuring machines are presently used to digitize film from the giant bubble chambers. The second PDP-11, together with the PDP-8, will be used to drive a mix of manual devices for the analysis of BEBC film; the first of these BEBC tables has been put in use for production measurements.

The second category of tasks consists of the off-line work, including geometrical reconstruction (when that step ins't available on-line at the time of measurement), kinematical analysis, DST making, general data manipulation, etc. These tasks are run, interactively or in batch mode, on the IIHE DEC-system 10 or on the Control Data 6600 or 6500 computers at the Brussels Universities Computer Centre.

All the physicists are involved on the design, programming, editing, testing, documentation and execution of these various tasks, together with the programmers (G. Depiesse, G. Rousseau, R. Vandenbroucke) and some engineers and technical staff. The IIHE computers are available in open shop, 24 hours per day and 7 days a week; their total unavailability doesn't exceed 4 % of the time. The management of these computers is under the responsibility of P. Van Binst; A. De Coster works as a half-time operator.

The configuration of the DEC-system 10 has been substantially increased by the

replacement of the central processor by a faster model (KI10), the addition of central memory to a total of 208 Kwords, as well as the expansion of some peripheral subsystems (moving head disks, tapes and terminals). The software has been upgraded accordingly (TOPS-10 monitor version 603).

V. TECHNICAL WORK.

1. Adaptation of the hardware of the automatic machine Polly to the requirements specific to film from the CERN BEBC-bubble chamber (L. Van Lancker, R. Goorens).

2. Rebuilding of the Prosam measurement machine into a high precision measurement device (R. Goorens, C. Nadin, G. Van Beek, L. Van Lancker).

3. On-line connection to a PDP-11 of scanning and measurement apparatus for BEBC film (J.P. De Wulf, L. Etienne).

4. Building of a scanning device for Gargamelle film (J.P. De Wulf, G. Van Beek).

5. Processing at CERN of the emulsion for the experiments reported in section II.1.2 and II.1.3 (C. Donis and M. Pins).

VI. ATTENDANCE TO CONFERENCES AND SCHOOLS.

- XIX International Conference on High Energy Physics, Tokyo: J. Sacton and F. Verbeure.

- International Meeting on "Frontier of Physics", Singapore: J. Sacton and F. Verbeure.

- Topical Conference on Neutrino Physics at Accelerators, Oxford: M. Dewit, J. Sacton, J. Wickens and G. Wilquet.

- Annual Meeting of the American Physical Society, Washington: D. Bertrand and J. Sacton.

- Neutrinos - 78, Purdue: D. Bertrand and J. Sacton.

-International Symposium on the Dynamics of multiparticle production, Tabor: E. De Wolf, J.J. Dumont and F. Verbeure.

- XIII^{e} Rencontre de Moriond- les Arcs: D. Johnson and C. Vander Velde-Wilquet.

- VIth Trieste Conference on Particle Physics: P. Vilain.

VII. LIST OF PUBLICATIONS.

- An analysis of K^+p interactions at 32 GeV/c in terms of principal axis variables
  E. De Wolf, M. Gijsen, S. Tavernier
  Nucl. Phys., B135, (1978) 365

- Inclusive production cross sections of resonances in 32 GeV/c K^+p interactions
  E. De Wolf, S. Tavernier, F. Verbeure
  Nucl. Phys., B140, (1978) 389

- Transverse momentum correlations and impact parameter bounds in K^+p interactions at 32 GeV/c
  E. De Wolf, M. Gijsen, S. Tavernier, F. Verbeure
  IIHE-78-3, Submitted to the XIV^e International Conference on High Eenrgy Physics, Tokyo, August (1978)

- Single diffraction dissociation in $\bar{p}p$ interactions at 32 GeV/c
  M. Csejthey-Barth, S. Tavernier, F. Verbeure
  Contributed to the IV European Antiproton Symposium - Strasbourg, june 26-30, 1978

- Inclusive production of K^* (890), Σ (1385) and S^* (993) resonances in $\bar{p}p$ interactions at 12 GeV/c incident momentum
  D.P. Johnson, J. Lemonne, P. Renton, F. Van Den Bogaert, J. Wickens ...
  Nucl. Phys., B140, (1978) 220

- A search for charmed particle production in $\bar{p}p$ interactions at 12 GeV/c
  D.P. Johnson, J. Lemonne, P. Renton, F. Van Den Bogaert, J. Wickens ...
  Nucl. Phys., B142, (1978) 53

- Some properties of the annihilation channels $\bar{p}p \rightarrow K^o_S K\, \pi^+\pi^+\pi^-(\pi^o)$ $\bar{p}p \rightarrow K^o_S K\, \pi^+ 2\pi^+ 2\pi^-(\pi^o)$ in 12 GeV/c $\bar{p}p$ interactions.
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