

INTER-UNIVERSITY INSTITUTE FOR HIGH ENERGIES

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J. LEMONNE and J. SACTON

(March 1977).

I. INTRODUCTION.

The physicists whose names are listed below have contributed to the different activities of the laboratory during the year 1976.

U.L.B.

D. Bertrand (chercheur IISN, until July 1976)
Gh. Bertrand-Coremans (Chef de travaux associé)
M. Csejthey-Barth (chercheur IISN-FNRS)
M. Dewit (boursier IRSIA)
J.J. Dumont (chercheur IISN)
J. Heughebaert (chercheur IISN-FNRS, until October 1976)
D. Johnson (chercheur IISN, until October 1976)
H. Mulkens (chercheur IISN)
J. Sacton (Professeur Associé)
P. Van Binst (chercheur IISN)
P. Vilain (chercheur IISN, from April 1976)
J. Wickens (chercheur IISN)
G. Wilquet (chercheur IISN)
C. Wilquet-Vander Velde (Assistant)

Notes : During the first three months of 1976 P. Vilain has been working at CERN (CERN fellowship) in the IISN group under the leading of J.P. Stroot.

D. Bertrand is now Boursier CERN.

J. Heughebaert has taken one year of leave from October 1976.

In October 1976, D. Johnson became IIKW vorser.

V.U.B.

C. De Clercq (vorser IIKW)

E. De Vos (Assistent, until October 1976)

M. Goossens (vorser IIKW)

M. Gysen (vorser IIKW)

J. Lemonne (Gewoon Hoogleraar)

P. Peeters (Werkleider)

P. Renton (vorser IIKW, until June 1976)

R. Roosen (Assistent)

S. Tavernier (vorser IIKW)

W. Van Doninck (vorser IIKW)

G. Van Homwegen (vorser IIKW)

F. Verbeure, E. De Wolf and F. Van Den Bogaert (from UIA) are working in close collaboration with the Institute.

The Scientific Committee of the Institute had a meeting on October 25, 1976 (chairman : F. Grard).

In May 1976, the two sections of the IIHE located at the Solbosch (ULB) and rue Hobbema were moved to the VUB Campus of the Oefenplein. Most of the members of the laboratory took an active part in this removal; this led to a minimal dead time in the scientific activities.

II. RESEARCH.A. Nuclear Emulsion Studies.

A.1. Search for short-lived particles (10^{-12} to 10^{-14} s) in the interactions of 300 GeV/c protons (G. Bertrand-Coremans and J. Sacton).

60.000 stars detected in an emulsion stack exposed at FNAL to a 300 GeV/c proton beam have been scrutinized for the presence of secondary interactions or decays occurring within ≤ 150 μ m from the primary vertex. No example was found of the associated production of short-lived particles. This negative result leads to an

upper limit of 1.5 μb (90 % C L) for the cross section of this process. The observed number of secondary interactions and their characteristics were found to be in agreement with the expectations for mesons and nucleons. This work was performed in collaboration with U.C. Dublin, U.C. London, Rome, Strasbourg and Warsaw.

A.2. Observation of a likely example of the decay of a charmed particle produced in a high energy neutrino interaction (G. Bertrand-Coremans, J. Sacton and P. Vilain).

Early in 1976, a total volume of 18 l of Ilford K5 emulsion was exposed to a wide band beam of high energy neutrinos ($\bar{E}_\nu = 40 \text{ GeV}$) at FNAL. The emulsion was used as a vertex detector, part of a hybrid system made of scintillation counters, 2 optical wide gap chambers, a shower detector and an elementary muon detector. The charged products of an interaction occurring in the emulsion are detected in the spark chambers; from the measurements of the tracks in the latter, the expected position of the primary vertex in the emulsion is inferred. From the known neutrino flux it is estimated that about 150 neutrino interactions should have occurred in the emulsion. Two third of these interactions have been searched for and 23 of them were found within an emulsion volume of $\sim 1 \text{ cm}^3$ around the predicted position. One event raises considerable interest^(*). After a path of 180 μm one of the 5 charged secondaries of minimum ionization gives three charged particles also compatible with minimum ionization without any sign of a nuclear recoil track. The event has the characteristics to be expected of the decay of an unstable particle involving at least one neutral secondary. A V^0 candidate is observed in the wide gap chambers pointing in the right direction to take off at least part of the imbalanced transverse momentum at the decay vertex. From kinematics and using multiple scattering measurements made on the charged decay secondaries it is possible to state that the observations are not consistent with either of the decays

(*) The event was found in Brussels.

$\Lambda_c(2.25) \rightarrow \Lambda^0 \pi\pi\pi$ or $D(1.87) \rightarrow K^0 \pi\pi\pi$. Many other decay modes are however possible for objects with invariant masses between 1.5 and 2.6 GeV/ c^2 .

The probability for the event to be due to an hadronic secondary emitted from the neutrino vertex undergoing an interaction with an emulsion nucleus is estimated, using the results of the previous experiment, to be $\sim 1/1000$.

The event is most readily interpreted as the decay of a charmed particle with lifetime of a few 10^{-13} s.

The other laboratories involved in this experiment are CERN, U.C. Dublin, Fermilab, U.C. London, O.U. London, Mulhouse, Rome and Strasbourg.

B. Bubble Chamber Studies.

B.1. Cryogenic chambers.

B.1.1. K^- d experiment at 4.6 GeV/c (C. De Clercq, D. Johnson, J. Lemonne, P. Peeters, P. Renton, P. Van Binst, G. Van Homwegen and J.H. Wickens).

This experiment has reached the final stage of data interpretation. The study of the elastic channels $K^- n \rightarrow K^- n$ and $K^- d \rightarrow K^- d$ has been completed and is submitted for publication. In addition the interpretation of the inelastic processes $K^- n \rightarrow K^- p \pi^-$ and $K^- d \rightarrow K^- d \pi^+ \pi^-$ has been started. This experiment will furnish the subject of the Ph.D. work of G. Van Homwegen.

B.1.2. K^- p experiment at 6.5 GeV/c (C. De Clercq, D. Johnson, J. Lemonne, P. Peeters, P. Renton and J.H. Wickens) - collaboration : Argonne National Laboratory, Brussels, University of Kansas, Michigan State University and Tufts University (USA).

The exposure of the 12' - H_2 filled Argonne bubble chamber with K^- mesons of 6.5 GeV/c momentum has been completed. A total sample of 50.000 events of the 0 prong-V, 4 prong and 4 prong-V topologies has been collected and partly measured.

A preliminary analysis of inclusive V^0 (K_s^0 , Λ^0) production has been communicated to the Tbilissi Conference. A fraction analysis

of the 4 prong sample based on a multidimensionnal statistical treatment of the data is in progress. The latter study will be one of the subjects treated by C. De Clercq in the preparation of her Ph.D. thesis.

B.1.3. $\bar{p}p$ experiment at 12 GeV/c (D. Bertrand, D. Johnson, J. Lemonne, P. Renton, F. Van Den Bogaert and J.H. Wickens) - collaboration : IIHE, CERN, I.C. London, Mons, Orsay.

This experiment for which the technical work is almost completed, has started in 1975 with the first high statistics exposure of the CERN-BEBC chamber filled with hydrogen to a beam of 12 GeV/c antiprotons.

The main purpose of this work was a search for narrow resonances. This search was successful : a 5.5 standard deviation evidence was found for the production in the 6 prong V-channel of a narrow state ($\Gamma \leq 18$ MeV) of mass $I = 2.6$ GeV, named I , decaying according to the mode :

$$I^{\pm} \rightarrow K_S^0 \pi^{\pm} \pi^+ \pi^-$$

The product of production cross-section times branching ratio for this particular decay mode is found to be $\sigma.B \simeq 20$ μ b.

Evidence (4 standard deviations) was also found for the decay of the I into $\bar{\Lambda} p n \pi^{\pm}$ and $\Lambda \bar{p} n \pi^{\pm}$ (with $n \geq 1$) modes. This new state is best interpreted as the first example of strange baryonium. Some 10 non-strange baryonium states found in $\bar{p}p$ annihilations were discussed at the 1976 Tbilissi Conference. Baryonium states could bring evidence for the existence of mesons containing four valence quarks, as strongly suggested by duality theories.

B.1.4. K^+ meson interactions at 32 GeV/c (M. Csejthely-Barth, J.J. Dumont, M. Gysen, S. Tavernier, F. Van Den Bogaert, F. Verbeure and E. De Wolf).

About 20.000 events have now been completely processed by the Belgian laboratories (IIHE and Mons), allowing useful results to be published, or presented at the Tbilissi Conference.

- The works on average charged multiplicities and elastic scattering, which had been presented at the Palermo Conference in a preliminary form, were finalized and published.
- Production of the K^* (890) was investigated. The production cross-section was shown to be growing with energy.
- Principal axes were searched in the momentum space of the outgoing particles in the 4C channels. Although some planarity effect was observed, it is consistent with predictions of uncorrelated models.
- The production of neutral kaons was analyzed in the fragmentation and central regions.

A preliminary study of the reaction $K^+ p \rightarrow K^+ \pi^+ \pi^- p$ is carried out. This work is done in the frame of the CERN-France-Soviet Collaboration.

B.1.5. $\bar{p}p$ interactions at 32 GeV/c (M. Csejthey-Barth, J.J. Dumont, M. Gysen, S. Tavernier, F. Verbeure and E. De Wolf).

The number of measured events being small (~ 9000), the physics results which were presented are very preliminary. However, cross-sections and structure functions were obtained for the inclusive production of K^0 , Λ , $\bar{\Lambda}$ and γ . The general characteristics of diffractive dissociation in the reaction $\bar{p}p \rightarrow \bar{p}p \pi^+ \pi^-$ were studied. Estimations of cross-sections for other 4C channels are also available.

The work is performed in the frame of the CERN-France-Soviet Collaboration.

B.1.6. K^-p interactions below 450 MeV/c using the TST technique.
(D. Bertrand, M. Goossens, G. Van Homwegen, G. Wilquet).

1. $\Lambda\pi^0$ and $\Sigma^0\pi^0$ channels at very low momentum (< 250 MeV/c).
IIHE - UCL Collaboration.

The rescanning of the 225.000 pictures for all events with a Λ^0 in the final state is completed.

The Λ/Σ^0 ratio at rest has been estimated from the Λ spectrum only for a subsample of events found in 25 Kpx. The final analysis is under progress. A careful account must be taken of the experi-

mental losses and biases, due to the peculiarity of the TST technique.

A similar study has just been started for the Λ/Σ^0 ratio at very low momentum (100 - 250 MeV/c).

The estimation of the $\Lambda\pi^0$ and $\Sigma^0\pi^0$ cross-sections in the momentum interval (100 - 250 MeV/c) will be based on the measurement of all the $\Lambda\gamma$'s events. Only 4/7 of the events have been measured for the first time so far.

2. $\Sigma^+\pi^+$ channels at very low momentum (< 250 MeV/c).
IIHE - UCL - Durham - Warsaw Collaboration.

A special scanning has been done in about 50.000 pictures in order to measure the Σ^-/Σ^+ ratio at rest. The analysis has been completed in early 1977. Although not yet final, the value found, 2.35 ± 0.04 , disagree completely with the value 2.06 ± 0.06 given in a previous measurement by Kim. It confirms the idea that Kim's global measurement of the K^-p interaction at low momentum, on which were based all the theoretical models so far, might be wrong. On the contrary, this value agree with a previous measurement in emulsion by the K^- collaboration namely 2.34 ± 0.07 . In the same study, a preliminary value of 0.484 ± 0.008 has been found for the decay ratio $\Sigma^+ \rightarrow p\pi^0/\Sigma^+ \rightarrow n\pi^+$, in agreement with the PDG value of 0.4835 ± 0.0073 .

A similar study in the momentum interval 100 - 250 MeV/c is at the scanning stage.

3. $\Lambda\pi^0$ and $\Sigma^0\pi^0$ channels in the momentum interval 250 - 450 MeV/c
IIHE - UCL - Durham - Birmingham Collaboration.

The 210.000 pictures have been scanned for the Λ final states and the measurement of the $\Lambda\gamma$'s events will be completed during the first half of 1977. An estimation of the $\Lambda\pi^0$ and $\Sigma^0\pi^0$ cross-sections in the momentum interval 250 - 450 MeV/c should be obtained in 1977.

B.1.7. K^- meson absorptions at rest in liquid helium. (R. Roosen, J. Sacton, and J.H. Wickens).

The channels at present under study in this experiment are :



where (ppn) represents any combination of the three nucleons. Some 8.000 events resulting from a scan of 117.000 frames have been processed in a search for the above reactions. A detailed interpretation of the results obtained in the light of the various primary and secondary interaction processes occurring when K^- mesons are absorbed in complex nuclei is currently being attempted.

Analysis of reactions (1) allows a study of the direct Λ hyperon production via $K^- n \rightarrow \Lambda \pi^-$ and the Σ hyperon conversion processes $\Sigma N \rightarrow \Lambda N$. For the direct production process, significant scattering inside the parent nucleus of the π^- meson (due to the proximity of the $\Lambda(1232)$ resonance) is observed. The momentum spectra of the proton and deuteron from the reaction $K^- + {}^4\text{He} \rightarrow \pi^- + \Lambda + p + d$ indicate a contribution from Σ hyperon conversion involving two nucleons ($\Sigma + d \rightarrow \Lambda + d$).

For the multinucleonic K^- meson absorption process of reaction (2), it appears that the two nucleons not involved in the primary reaction can, to a first approximation, be considered to act as a spectator deuteron.

The material of this experiment made in collaboration with U.C. London will be the basis of the Ph.D. of R. Roosen.

B.2. Heavy liquid chambers.

$\nu(\bar{\nu})$ interactions in Gargamelle (Gargamelle Collaboration).

The freon experiment (G. Bertrand-Coremans, M. Dewit, H. Mulkens, J. Sacton, W. Van Doninck)

(i) $\bar{\nu}_\mu e^- \rightarrow \bar{\nu}_\mu e^-$: Three unambiguous candidates for this reaction have been observed corresponding to a cross-section for a recoil electron energy between 0.3 and 2 GeV of $0.6 \times 10^{-42} E_- (\text{GeV}) \text{ cm}^2 / \text{electron}$. The estimated background is 0.44 ± 0.13 events $\bar{\nu}$ and the probability that all three candidates could be due to background is 1 %.

(ii) dilepton and strange particle production by neutrinos :

In a sample of 41.000 charged current neutrino induced reactions, three events have been found containing a negative muon, a positron and a V^0 particle. The total background due to ν_e interactions and to electromagnetic processes is 0.09 ± 0.03 events. The three V^0 particles are either Λ or K^0 (a statistical analysis favouring the Λ^0 hypothesis). In addition, 17 $\mu^- e^+$ pairs without V^0 particles have been seen of which only 6.1 ± 1.8 can be explained by background contributions. The remaining (11 ± 5) events and the 3 $\mu^- e^+ V^0$ are attributed to a new phenomenon : the production of a charmed particle decaying semileptonically : $\nu_\mu + \text{nucleon} \rightarrow \mu^- + C (\rightarrow e^+ \nu_e (V^0)) + \text{non strange hadrons}$. Correcting for background and signal loss, the production rate of charmed particles (assumed mass 2 GeV) decaying semileptonically ($E_e > 300$ MeV) is found to be 0.31 ± 0.13 %.

No evidence for charm production has been found in neutral current neutrino induced reactions.

(iii) neutral to charged current inclusive cross-sections :

The ratios of neutral to charged current cross-sections for events with hadronic energy greater than 1 GeV have been found to be $R_\nu = 0.25 \pm 0.04$ and $R_{\bar{\nu}} = 0.56 \pm 0.08$. Assuming the validity of scaling and a V and/or \bar{V} A type structure for the neutral current, these ratios have been corrected for the cut on the hadron energy. The results are 3 standard deviations away from the predictions of parity conserving models and in good agreement with the Salam Weinberg model with $\sin^2 \theta_W = 0.32 \pm 0.05$.

(iv) the isospin properties of the weak neutral current :

A study has been made of the one pion neutral current reactions $\nu(\bar{\nu}) + \text{nucleons} \rightarrow \nu(\bar{\nu}) + \pi + \text{nucleons}$ to deduce the isospin properties of the weak neutral current. Correcting the observed rates of π^0 and π^\pm production for background and secondary nuclear interactions it is concluded that the data are inconsistent with the hypothesis of a pure $\Delta I = 0$ transition.

(v) A full analysis of the inclusive reactions $\nu(\bar{\nu}) + \text{nucleon} \rightarrow \nu(\bar{\nu}) + \text{nucleon}$ and $\nu(\bar{\nu}) + \text{nucleon} \rightarrow \mu^- (\mu^+) + \text{nucleon}$ will be the subject of the Ph.D. of W. Van Doninck.

The propane experiment (G. Bertrand-Coremans, M. Dewit, H. Mulkens, J. Sacton, C. Wilquet-Vander Velde, W. Van Doninck and P. Vilain).

In this experiment, the priority has been given to the analysis of the neutral-current interactions of the type :

$$\nu + \text{nucleon} \rightarrow \nu + \text{nucleon} + \text{one pion.}$$

The Gargamelle chamber, filled with a propane-freon mixture, is well suited to this study : the identification of π^+ and π^- mesons is possible in about 60 % of the cases, the π^0 detection probability is not too low (about 0.5) and final state interactions due to nuclear effects can be reliably calculated.

The analysis is based on 320.000 pictures, corresponding to a total of about 3.000 ν interactions. The more important background sources are neutron interactions. They are estimated from the observation of the channels : neutron + nucleon \rightarrow nucleon + nucleon + one pion in an experiment where Gargamelle was exposed to a 4 GeV/c proton beam. After background subtraction and correction for detection efficiency and nuclear effects, the observed rates of the different final states can be analysed in term of the isospin structure of the neutral current. Furthermore, within a theoretical model, like the Salam Weinberg model, the comparison with the corresponding charged-current channels allows to determine the vector and axial vector coupling constants for neutral currents.

The results of this experiment will be available within the next few months. Other subjects are now being investigated :

- strange particle production
- ratio between total cross-sections of neutrinos.

C. IIHE Participation to the EHS.

(Technical preparation : S. Tavernier and F. Van Den Bogaert).

It is clear that further research in strong interactions will use hybrid systems or even purely electronic systems rather than bubble chambers. For this reason the IIHE has expressed his interest for the European Hybrid Spectrometer (EHS) project. The EHS consists of a rapid cycling bubble chamber and a number of detectors to localise and identify the particles downstream of the bubble chamber.

We took up a suggestion made independently by J.P. Stroot and E. Johansson to use silica aerogels for the identification of slow particles in the final state. The newly developed silica aerogels are solid materials with optical refraction indices between 1.01 and 1.3. Until recently these refractive indices could only be obtained with gasses under high pressure. In collaboration with the University of Mons, the University of Stockholm and the IISN group at CERN a proposal has been introduced to build a Cerenkov detector for slow particle identification based on silica aerogels.

Two series of tests were made at CERN (from 6/5 to 14/5 and from 30/8 to 15/9) on small samples of aerogel obtained from the CEA, Saclay. It was confirmed that Cerenkov effect is indeed observed in these samples. Furthermore the light output from a small scale prototype detector could be measured. The small light output of these detectors is indeed the main technical difficulty in these detectors.

In addition a program to predict the light output from such detectors was developed and a fair agreement was obtained between the measured values for the small scale prototype and the calculations. A realistic full scale detector has been designed which will be tested at CERN soon.

III. SEMINARS AND LECTURES.

- The practical work for students attending the lectures of J. Lemonne and J. Sacton (3rd and 4th years in 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.

- The following people have contributed to a series of lectures for postgraduate students.

G. Wilquet (in collaboration with R. Windmolders from the University of Mons) : measurement of the intrinsic properties of particles and resonances.

J. Lemonne and P. Renton (in collaboration with J. Nuyts from the University of Mons) : semi-leptonic decays of hadrons.

- F. Verbeure (in collaboration with F. Grard and V.P. Henri from the University of Mons) : strong interactions at very high energies.
- J. Sacton has been invited to give a talk at the Washington Symposium of the division of Particles and Fields of the American Physical Society (Muon-neutrino reactions producing a charged lepton pair and a strange particle in Gargamelle).
 - J. Sacton has been invited to participate to the Gordon Research Conference on Elementary particle interactions at Tilton (Charm search in 300 GeV/c proton interactions; Dileptons in the Gargamelle experiment).
 - J. Sacton has been invited to give a talk at Saclay (observation directe d'une particule chargée à vie courte produite par interaction de neutrinos dans l'émulsion nucléaire).
 - D. Johnson has been invited to give a talk at the University of Warsaw (Elastic K^-d scattering at 4.5 GeV/c).
 - W. Van Doninck has given a talk at the Neutrino Conference in Aachen (Neutral current induced reactions in the Gargamelle experiment).
 - J. Lemonne has been invited to give a talk at the 3rd European Symposium on antinucleon-nucleon interactions (Inclusive V^0 production in $\bar{p}p$ interactions at 12 GeV/c).
 - J. Lemonne has made a public defence at CERN of the proposal "The study of prompt lepton production in $\bar{p}p$ interactions at 70 GeV/c in BEBC equipped with a TST".
 - F. Verbeure has been invited at the University of Nijmegen (on the account of the International Bilateral agreements) to give a colloquium (Recent results in K^+p interactions) and a seminar (Azimuthal correlations in multiparticle final states).
 - In the frame of a Seminar on Elementary Particles organized by the Institute, the following lectures were given :
 - W.D. Shephard (Notre Dame - Indiana) : the FNAL hybrid System
 - J. Lemonne : Comments on new experimental results presented at the Tbilissi Conference
 - W. Kittel (Nymegen) : Recent results from the high statistics bubble chamber experiment K^-p at 4.2 GeV/c
 - Internal seminars (organized by M. Goossens) were given by :
 - C. De Clercq, M. Goossens, P. Vilain, J. Lemonne (2), E. De Wolf (2), S. Tavernier (2), G. Wilquet, J.J. Dumont, P. Van Binst, R. Roosen, J. Sacton.

IV. COMPUTERS AND SOFTWARE.

A variety of computers are being used for the development of new programs and the running of production jobs. These are :

- at the Computer Centre of the Brussels Universities : one CDC 6600 and one CDC 6500
- at the IIHE : one DEC system 10, two DEC PDP-11/40's, one DEC, PDP-8.

All of these computers can process data on 7 or 9-tracks mag tapes, and it is a non-trivial job to organize the necessary data transfers and format conversions. These tasks are essentially handled by the IIHE programmers (G. Depiesse, G. Rousseau, R. Tassin-Vandenbroecke).

The management of the IIHE computers has been done by J.J. Dumont and P. Van Binst.

Below appear some details on the workload on the various computers :

- Computer Centre.

The use of the Computer Centre facilities has been extremely difficult in 1976, due to a number of problems connected with the installation of a new CDC 6600 computer, the NOS operating system, and a remote job entry and time-sharing system.

- Production jobs :

- GRIND kinematics for the 30" K^- experiment (J. Wickens)
- HYDRA geometry and kinematics, and a DST program for the Mirabelle experiments (M. Csejthey-Barth, J.J. Dumont)
- HYDRA geometry for the Rutherford TST experiment (G. Depiesse, M. Goossens, G. Wilquet, D. Bertrand)
- analysis of the results of the 2 m K^+ experiment (E. De Wolf, F. Verbeure).

- New developments :

- enhancements of the Benson plotter software (M. Gysen)
- DST program for the 30" K^- experiment (J. Wickens)
- implementation of the PATCHY4 update program (J.J. Dumont)
- implementation of the CERN cluster analysis program (C. De Clercq).

- DEC system 10.

New hardware has been added to the IIHE main computer : an RHS04 fixed-head disks system and a TU10 9-track tape unit. Two new versions of the TOPS-10 operating system have been implemented to support these new equipments and optimize the overall system (P. Van Binst).

Various new releases of DEC distributed software have also been tested and implemented (G. Depiesse, G. Rousseau, P. Van Binst).

- Production jobs :

- BROL : support of the POLLY measuring device (with associated TVGP geometry program), two tables for measurement of Gargamelle pictures (with associated HYDRA geometry program) and one table for scanning and pre-measurement of Mirabelle pictures
- HYDRA kinematics and a DST program for the Rutherford TST experiment (G. Depiesse, M. Goossens, G. Wilquet)
- bookkeeping programs for the K^-d and K^-p experiments (C. De Clercq)
- data handling and analysis programs for the following experiments :
 - Helium (R. Roosen)
 - 2m and Mirabelle K^+ (E. De Wolf, F. Verbeure)
 - Fermilab emulsion (P. Vilain)
 - 30" K^-d (G. Van Homwegen, J. Wickens)
 - BEBC $\bar{p}p$ (F. Van Den Bogaert, J. Wickens)
 - Rutherford TST (G. Wilquet)
 - Gargamelle (G. Bertrand-Coremans, M. Dewit, H. Mulken, W. Van Doninck, P. Vilain, C. Wilquet-Vander Velde).

- New developments :

- completion and enhancements of the Mirabelle on-line system (M. Gysen)
- completion of the POLLY software for measurement of BEBC pictures with on-line TVGP geometry (P. Renton, J. Wickens)
- simulation of Cerenkov counters (S. Tavernier)
- HYDRA geometry for BEBC, HYDRA kinematics for TST, PATCHY4 update program (D. Bertrand)
- enhancements of the Gargamelle on-line system (H. Mulken, R. Tassin-Vandenbroecke, G. Wilquet, D. Bertrand).

- CERN beam monitoring program (H. Mulkens)
- HYDRA BEBC and Gargamelle EMI software (P. Vilain).
- PDP-11/40's.

The two PDP-11's are running versions of the RSX-11M operating system (R. Tassin-Vandenbroecke, P. Van Binst).

The "BEBC" computer has been used to develop and test conversion routines for tape transfers to and from the two large computers (J.J. Dumont, G. Rousseau).

The "SWEEPNIK" computer is used for all the software developments relative to this new measuring device : operating system, acceptance tests, calibration, Mirabelle software (R. Tassin-Vandenbroecke P. Van Binst).

- PDP-8.
- processing of the Rutherford TST experiment measurements (G. Depiesse)
- tests of the PROSAM measuring device (G. Rousseau, S. Tavernier).

V. TECHNICAL WORK.

1. Delivery, installation and acceptance of the new DEC system 10 elements (RHS04 and TU10), and of the two PDP-11/40 minicomputers and peripheral equipment (P. Van Binst).
2. Delivery, installation, acceptance and debugging of the SWEEPNIK automatic measuring device (J.P. De Wulf, L. Etienne, R. Tassin-Vandenbroecke, P. Van Binst).
3. Debugging of the POLLY device after the move to the new lab (J.P. De Wulf, L. Etienne, R. Goorens, P. Van Binst), followed by accuracy and reliability tests (R. Goorens, P. Van Binst, J. Wickens).
4. Planning of the rebuilding of the PROSAM measurement machine into a high precision measurement device (R. Goorens, C. Nadin, G. Van Beek, L. Van Lancker).

5. Final study of a scanning and pre-measurement apparatus for BEBC film (J.P. De Wulf, G. Van Beek).
6. Building in our workshop of a scanning device for Gargamelle film (J.P. De Wulf, G. Van Beek).
7. G. Bertrand-Coremans, C. Donis and J. Sacton have had in charge the processing of the 18 l of emulsion from the FNAL experiment as well as a series of technical tests for the WA 17 experiment to be carried in CERN in front of BEBC. All these operations made use of the CERN processing facilities.
8. R. Gindroz and Ch. Wastiels spent a few weeks in CERN working on the hardware for WA 17.

VI. ATTENDANCE TO CONFERENCES, SCHOOLS AND MEETINGS.

A. Conferences.

- Topical Conference on Baryon Resonances - Oxford - July 1976 : D. Johnson and G. Wilquet.
- American Physical Society Meeting - Washington - April 1976 : J. Sacton, P. Vilain.
- Production of Particles with New Quantum Numbers - Madison - April 1976 : J. Sacton, P. Vilain.
- Gordon Research Conference on Elementary Particle Interactions - Tilton - August 1976 : J. Sacton.
- Neutrino Conference - Aachen - June 1976 : H. Mulkens, G. Bertrand-Coremans, J. Sacton, W. Van Doninck.
- Topical Conference on Weak Interactions - Brighton - July 1976 : C. Wilquet-Vander Velde.
- XVIIIth International Conference on High Energy Physics - Tbilissi - July 1976 : J. Lemonne.
- Conference on Computer Assisted Scanning - Padova - April 1976 : J. Wickens, P. Van Binst, P. Renton.
- Third European Symposium on Antinucleon-nucleon Interactions - July 1976 : J. Lemonne, J.H. Wickens.
- Topical Meeting on Multidimensional Data Analysis - CERN - January 1976 : C. De Clercq, J.J. Dumont, F. Verbeure.

- Meeting on Petra - Frascati - March 1976 : J. Sacton.
- P. Van Binst has collaborated to the organization of the DEC system 10/20 European Users Group Spring Meeting in Brussels - May 1976.
- DECUS European Symposium - Munchen - September 1976 : P. Van Binst.
- International Colloquium on Multiparticle Reactions - Tutting-Munchen - June 1976 : F. Verbeure.
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