

INTER-UNIVERSITY INSTITUTE FOR HIGH ENERGIES
ULB - VUB; Brussels - Annual Report 1974.

J. LEMONNE and J. SACTON
(January 1975).

I. INTRODUCTION.

The physicists whose names are listed below have contributed to the different activities of the laboratory during the year 1974.

U L B.

D. Bertrand (chercheur IISN)
Gh. Bertrand-Coremans (Chef de travaux associé)
M. Csejthey-Barth (chercheur IISN)
J.J. Dumont (chercheur IISN)
J. Heughebaert (chercheur IISN)
D. Johnson (chercheur IISN)
H. Mulkens (chercheur IISN)
J. Sacton (Professeur Associé)
T. Tymieniecka (chercheur IISN)
P. Van Binst (chercheur IISN)
P. Vilain (chercheur IISN; up to April 1974; then at CERN)
J. Wickens (chercheur IISN)
G. Wilquet (chercheur IISN)
C. Wilquet-Vander Velde (Assistant)

V U B.

C. De Clercq (vorser IIKW)
M. Goossens (vorser IIKW)
M. Gysen (vorser IIKW; from October 1974)
J. Lemonne (Professor)
G. De Jongh (vorser IIKW; until July 1974)
P. Peeters (Eerst aanwezig assistant)
P. Renton (vorser IIKW)
R. Roosen (Assistant)

S. Tavernier (vorser IIKW)

W. Van Doninck (vorser VUB)

F. Verbeure (Professor from UIA) and F. Vanden Boogaerde are working in close collaboration with the Institute.

The Scientific Committee of the Institute had a meeting on June 17, 1974 (chairman : J. SACTON).

II. RESEARCH.

A. Nuclear Emulsion Studies.

The experiments in progress are done in the frame of a Collaboration grouping the following laboratories : University of Belgrade; Institut für Hochenergiephysik - Akademie der Wissenschaften der DDR-Berlin; Institute for Advanced Studies-Dublin; University College-Dublin; University College London; University of Warsaw and Institute for Nuclear Research-Warsaw.

A.1. Hypernuclear Physics (Gh. Bertrand-Coremans, J. Sacton and T. Tymieniecka).

- Three papers presenting the results of a detailed study of final interactions in the decay modes ${}^8_{\Lambda}\text{Li} \rightarrow \pi^- + {}^4\text{He} + {}^4\text{He}$, ${}^{12}_{\Lambda}\text{B} \rightarrow \pi^- + {}^4\text{He} + {}^4\text{He} + {}^4\text{He}$ and ${}^7_{\Lambda}\text{Be} \rightarrow \pi^- + p + p + p + {}^4\text{He}$ have been prepared. A fourth paper has been written which summarizes the present status of the study of particle unstable hypernuclear excited states in emulsion and presents some new data concerning the binding energy values for hypernuclei of mass number greater than 10. Some of these contributions have been published recently (see list of publications); the others have been accepted for publication in Nuclear Physics and will appear soon.

- Kinematic analysis of simple hypernuclear production reactions by stopping K^- mesons has produced a sample of ${}_{\Lambda}\text{B}$, ${}_{\Lambda}\text{C}$ and ${}_{\Lambda}\text{N}$ hypernuclei with negligible background. The non-mesonic to π^- mesonic decay ratio for these events was found to be 5.5 ± 0.5 . The stimulated decay of these hypernuclei has been studied; the Λ neutron stimulation fraction was measured and found to be 0.37 ± 0.06 in agreement with the value obtained for lighter hyper-

nuclei. A sub-sample of ${}_{\Lambda}^{11}\text{B}$ hypernuclei was separated on the basis of the production via the excited state of ${}_{\Lambda}^{12}\text{C}$.

- A study of the final state interactions in the decay of ${}_{\Lambda}^7\text{Li}$, ${}_{\Lambda}^9\text{Li}$, ${}_{\Lambda}^8\text{Be}$ and ${}_{\Lambda}^9\text{Be}$ hypernuclei is in progress. The major difficulty of this work is to overcome the problem posed by the many kinematic ambiguities.

A.2. K^+ meson decays (D. Bertrand and J. Sacton).

About 500.000 K^+ meson decays at rest have been detected in a 1.5 litre emulsion stack exposed at the Brookhaven PS. A second scan of the material has now been nearly completed. Some 3.000 τ^+ and 3.000 $K_{\mu 3}$ decays with the charged decay product having a range in the emulsion less than 1.5 cm have been identified. The comparison of the energy spectra of the π^+ meson and the μ^+ with the data obtained in bubble chamber shows small discrepancies. Checks are in progress to investigate possible biases.

B. Bubble Chamber Studies.

B.1. Cryogenic chambers.

B.1.1. K^+p experiment at 16 GeV/c (D. Johnson, P. Peeters and F. Verbeure).

Part of the experiment undertaken in Collaboration by Brussels, Birmingham, CERN and Saclay consists in a search for diffractive N^* ($I = 1/2$) resonance production in the reaction $K^+ + p \rightarrow K^+ + \pi^+ + n$. Background due to reactions of the type $K^+ + p \rightarrow K^+ + p + \pi^0$ or $K^0 + p + \pi^+$ has been considerably reduced by rejecting events consistent by ionization with a proton in the final state. This checking has been completed for the Brussels sample of events. The final DST for the Brussels and CERN samples will be made by the beginning of 1975.

Studies of inclusive reactions yielded results which are already published or presented at Conferences and are still in progress. Exclusive reactions with high multiplicities are presently being investigated.

B.1.2. K^+d experiments (G. De Jongh and S. Tavernier).

The analysis of K^+d interactions at 4.6 GeV/c has been completed. Four papers have been published and one is in press concerning (i) the simultaneous production of K^{*0} (892) and Δ^{++} (1236) in the reaction $K^+ + d \rightarrow K^+ + \pi^+ + \pi^- + p + n_s$, (ii) the backward production of K^* (892) in $K^+ + N \rightarrow K + \pi + N$, (iii) the reaction $K^+ + d \rightarrow K^0 + \pi^+ + d$, (iv) the K^* (1420) decay branching ratios and (v) the coherent production of pions in K^+d interactions

(see list of publications).

The final DST of the K^+d experiment at 8.25 GeV/c is available since October. The channels which are presently analysed are $K^+ + d \rightarrow K^+ + \pi^- + p + p$ and $K^+ + \pi^+ + \pi^- + d$. Preliminary results on the former reaction have been presented at the London Conference.

The results of a theoretical analysis of the coherent reactions have also been published in Nuovo Cimento (see list of publications).

B.1.3. K^-d experiment at 4.6 GeV/c (D. Johnson, J. Lemonne, P. Peeters, P. Renton, P. Van Binst, J.H. Wickens and C. De Clercq). This experiment is made in film (350.000 frames) which has previously been partly analysed by the Purdue (U.S.A.) bubble chamber group. More than 10.000 events of the 3 prong topology, with or without an additional proton spectator track, scanned by the Purdue group have already been measured on the Brussels Polly. In addition, the scanning for events of the type 1 prong + spectator has been undertaken at Brussels in approximately 100.000 frames and complete measurement and analysis chains have been set-up for the treatment of both topologies. The most important channels to be analysed in this experiment are :

$$K^-n \rightarrow K^-n \quad (1)$$

$$K^-n \rightarrow K^-p\pi^- \quad (2)$$

$$K^-n \rightarrow K^-n\pi^+\pi^- \quad (3)$$

$$K^-d \rightarrow K^-d\pi^+\pi^- \quad (4)$$

The pure $I = 1$ elastic scattering channel has never been analysed at incident momenta greater than 3 GeV/c. The remaining channels will be analysed for resonance production (Q bump, $K^* \Delta$ production, Veneziano analysis) and $K^- \pi^-$ scattering.

B.1.4. K^-p experiment at 6.5 GeV/c (C. De Clercq, D. Johnson, J. Lemonne, P. Peeters, P. Renton, P. Van Binst and J.H. Wickens). Some 400.000 frames of this 10^6 pictures experiment have already been taken and shared among the following laboratories : Argonne National Laboratory, Brussels, Kansas, Michigan State University and Tufts University (Boston). Brussels is analysing

(scanning) 0 prong V events in collaboration with Tufts University. This will allow the study of the missing mass (MM) distributions in reactions of the type

$$K^-p \rightarrow \Lambda^0 + MM \quad (1)$$

$$K^-p \rightarrow \bar{K}^0 + MM \quad (2)$$

Previous, comparatively low statistics experiments have indicated the existence of considerable resonance structure in these MM-systems, in particular in reaction (1).

Brussels is also scanning and measuring (10.000 events completed) 4 prong events (with or without an associated V^0). The aim is to measure at least 150.000 of those events on Polly within the next 3 years and to concentrate the analysis mainly on the spectroscopy of high mass ($\sim 2 \text{ GeV}/c^2$) baryons.

To reach this goal, a considerable technical effort is required, which will be based on the especially adopted scanning, premeasurement and subsequent automatic measurement chain which has been essentially developed during 1974 and is expected to enter into production in January 1975.

B.1.5. π and K meson interactions at high energy in Mirabelle

(M. Csejthey-Barth, J.J. Dumont, M. Gysen, S. Tavernier, F. Vanden Boogaerde and F. Verbeure).

The exploratory experiment on inclusive production of neutral particles in K^+p interactions at 32 GeV/c is now finished. Results on cross sections, rapidity and transverse momentum distributions for production of K^0 , Λ and $\bar{\Lambda}$ have been published. Furthermore, a measure of the correlation between π^0 mesons and charged particles was obtained for both K^+p and K^-p interactions (see list of publications).

Concerning the high statistics experiment (K^+p), the scanning and premeasurement of film taken during the last three runs is in progress. The geometry and kinematics HYDRA programs were implemented, allowing the full processing of a first complete sample of events. Preliminary results on inclusive π meson production were obtained, showing the onset of scaling in the proton fragmentation region (submitted to Soviet Nucl. Phys.)

On the other hand, starting from the published Mirabelle data, a compilation of multiplicity distributions for all the incident particles was carried out. A comparative study has allowed to point out interesting regularity properties of these distributions, which put severe constraints on the building of models for hadron production (see list of publications).

B.1.6. Stopping K^- mesons in helium (R. Roosen, J. Sacton, C. Vander Velde-Wilquet and J.H. Wickens).

This experiment is made in collaboration with University College London.

A measurement has been made of the K^- meson and Σ^- hyperon cascade times in liquid helium, with the results $T(K^-) = (3.1 \pm 0.4) \times 10^{-10}$ s, and $T(\Sigma^-) < (2.8 \pm 0.8) \times 10^{-11}$ s (see list of publications). These results have confirmed the anomalously long cascade time previously determined for K^- -mesons, while the new determination of a much shorter time for Σ^- hyperons lends support to the hypothesis of metastable orbits in K^- -mesonic helium atoms.

The analysis of some 20.000 K^- -meson interactions at rest in helium producing Λ -hyperons is nearing completion. Data summary tapes are now available and analysis of the data is in process. This work will form the basis of a Ph.D. thesis by R. Roosen.

B.1.7. K^-p interactions at low energy in a hydrogen filled track sensitive target surrounded by a H_2 -Ne mixture (D. Bertrand, M. Goossens, T. Tymieniecka and G. Wilquet).

i) K^-p interactions at rest : (Brussels, UC London Collaboration; 225.000 pictures). Study of the $\Lambda\pi^0/\Sigma^0\pi^0$ ratio at rest and below 200 MeV/c.

About 42.000 frames have been scanned and 20.000 rescanned. A sample of some hundreds events has been measured.

ii) K^-p interactions between 200 and 575 MeV/c : (Birmingham, Brussels, Durham, UC London Collaboration; 675.000 pictures). Phase shifts analysis of the neutral channels and search for bumps. About 32.000 frames have been scanned and 15.000 rescanned. No significant measurement has been done yet.

A program for decoding the paper tapes produced by the measuring machines has been put into operation. A version of the geometry program HYDRA had to be adapted to the peculiar case of the TST

technique. Scattering length and phase shift analysis program are being developed.

B.2. Heavy liquid chambers.

B.2.1. Stopping K^- mesons in a propane-ethane mixture (J. Sacton, C. Vander Velde-Wilquet and J.H. Wickens).

The experimental work done in collaboration with University College London has been finalized. The results concerning $\Sigma\Lambda$ conversion, Λ^0 hyperon capture and $\Sigma\pi$ pair production have been summarized in a paper which has been accepted for publication in Nuclear Physics. These data and an analysis of the Λ hyperon production processes will constitute the basic material for the Ph.D. thesis of C. Vander Velde-Wilquet.

B.2.2. K^+ meson decays in propane (D. Bertrand, M. Cséjthey-Barth, J. Lemonne, P. Renton and P. Vilain).

The analysis of K_{e3}^+ decays in a propane-ethane mixture, based upon the inspection of 500.000 K^+ decays is completely finished. The results of a $K_{\mu3}/K_{e3}$ branching ratio analysis leading to model independent determination of the form factor ratio in terms of the four-momentum transfer q^2 has been published (see list of publications) and a paper presenting a global analysis of all the data available in the experiment has been submitted to Nuclear Physics. The analysis of the τ' -decay mode is still made at the level of the Data Summary Tape. These data could be combined with those obtained in the emulsion experiment described in section A.2.

B.2.3. Study of the $\Lambda\Lambda$ interaction (G. Wilquet).

(Brussels, CERN, Rutherford, Tufts, UC London Collaboration).

The technical part of the experiment is now completed and the analysis is nearly finished; a paper will soon be submitted for publication. There was an indication (3.7 s.d.) for a possible resonance in the $\Lambda\Lambda$ system at $2370 \text{ MeV}/c^2$, in a sample of 393 events of the type $K^-p \rightarrow K\Lambda\Lambda + n \pi$'s where the presence of a K meson in the final state was taken as an evidence for the production of strangeness -2 state. This indication has disappeared now that the events with no clear K signature have been included in the analysis (total of 878 events). No explanation other than a statistical fluctuation has been found yet.

B.2.4. ν ($\bar{\nu}$) interactions in Gargamelle (G. Bertrand-Coremans, H. Mulken, J. Sacton, W. Van Doninck and P. Vilain).

(a) The freon experiment.

- Seven laboratories are participating in this work : Aachen, Brussels, CERN, Ecole Polytechnique-Paris, Milano, Orsay, University College London. The data taking has been completed in December 1974. The total material consists of some 400.000 pictures taken in the neutrino beam and some 1.700.000 pictures taken in the antineutrino beam (900.000 $\bar{\nu}$ pictures with the booster).
- First priority has been given to the scanning, rescanning and checking of the $\bar{\nu}$ films for the reaction

$$\bar{\nu}_{\mu} + e^{-} \rightarrow \bar{\nu}_{\mu} + e^{-}$$

About 4/5 of the material has been presently analyzed and two candidates for this reaction have been found. A careful study of the background is in progress. A status report of this search was presented at the London Conference (July 1974).

- A detailed account of the results of the experiment concerning neutrino-like interactions without muon or electron (neutral currents) has been published in Nuclear Physics (see list of publications). Further statistics on these interactions have been accumulated in the $\bar{\nu}$ films which confirm the earlier findings. These data were presented at the London Conference (July 1974) together with different experimental tests about the validity of the Monte Carlo calculation used to estimate the neutron background.
- The differential cross sections of inclusive charge-changing neutrino and antineutrino interactions on nucleons ($1 < E < 11$ GeV) has been determined with respect to the scaling variables $x = q^2/2M\nu$ and $y = \frac{\nu}{E}$. For $q^2 > 1$ and $W > 4$ GeV² the x and y distributions are consistent with scaling. Using the variable $x' = q^2/(2M\nu + M^2)$ new structure functions $\bar{F}_2^{\nu N}(x')$ and $\bar{F}_3^{\nu N}(x')$ have been defined and found to be independent of the neutrino energy. The validity of the Gross-Llewellyn Smith and Adler sumrules has been tested successfully. All these results seem to support precocious scaling. A full account of this work will be published in Nuclear Physics.
- A study of strange particle production in $\nu(\bar{\nu})$ interactions is in progress.

(b) The propane experiment.

This experiment has been designed (i) to determine the cross sections of ν and $\bar{\nu}$ interactions on proton and neutron, (ii) to study the details of the hadrons in inelastic processes on free protons, (iii) to bring out the gross features of various neutral current channels, such as elastic scattering and single pion production. A first lot of pictures has been taken in mid 1974 to allow the set-up of scan rules, measurement procedures and analysis systems. The laboratories involved in the analysis of the ν films are : Aachen, Brussels, CERN, Ecole Polytechnique-Paris, Orsay and Padova.

C. New Proposals.

A serie of proposals for experiments to be carried out at Serpukhov, FNAL and CERN SPS have been prepared in collaboration with different laboratories.

C.1. Searches for short-lived particles ($10^{-15} < \tau < 10^{-12}$ sec.).

- A proposal has been introduced at FNAL (and accepted) to search for the production of short-lived particles in the interactions of 400 GeV protons with emulsion nuclei. The exposure is expected to take place early in 1975. (Brussels, Dublin, UC London and Warsaw).
- A proposal to search for short-lived particles produced in neutrino interactions in emulsion using a spark chamber-emulsion hybrid detector has been prepared by a Collaboration including Brussels, Dublin, London, Rome, Strasbourg and FNAL. It will be submitted to FNAL early in 1975.

C.2. Neutrino physics.

Three experiments have been proposed whose main objectives are as follows

- (i) a study of leptonic neutral currents and ν_e ($\bar{\nu}_e$) interactions in Gargamelle exposed to a wide band beam
- (ii) a study of semi-leptonic neutral currents in BEBC equipped with a deuterium filled track sensitive target and exposed to a neutrino narrow band beam
- (iii) a study of strange particle production in ν ($\bar{\nu}$) interactions observed in BEBC equipped with an hydrogen filled track sensitive target and exposed to a wide band beam.

C.3. Strong interaction physics.

The following proposals and letters of intent have been introduced to the CERN SPS Committee.

(i) proposal for a 500 K pictures exposure of BEBC in a 70 GeV K^+ separated beam (Birmingham, Brussels, CERN, Genova, Mons).

(ii) proposal for a study of $\bar{p}p$ interactions in BEBC with a 70 GeV \bar{p} separated beam (Brussels, Mons).

(iii) letter of intent concerning the study of $\bar{p}p$ interactions at 50, 100, 150 and 200 GeV/c by means of a rapid cycling bubble chamber (Brussels, MIT, Padova and Strasbourg).

III. PH.D. THESIS, "MEMOIRES DE LICENCE", PRACTICAL WORK FOR STUDENTS AND SEMINARS.

- P. Van Binst has obtained the degree of Ph.D. after submission of an original dissertation intituled :

"Mesure de clichés de chambres à bulles assistée par ordinateur".

- Five students spent the academic year in the Institute to prepare their "mémoire" :

L. Frappez : Contribution à l'étude des interactions quasi-élastiques de neutrinos et d'antineutrinos entre 1 et 10 GeV dans Gargamelle.

C. Gill : Reconstruction géométrique dans une chambre à bulles cryogénique contenant une cible d'hydrogène.

M. Gijzen : Bijdrage tot de studie van π^0 mesonen produktie in K^+p wisselwerkingen by 32 GeV/c.

M. Schleusner : Contribution à l'étude des interactions inélastiques de neutrinos et d'antineutrinos à haute énergie dans Gargamelle.

F. Vanden Bogaert : Studie van t' en massaverdelingen in de reactie $K^+p \rightarrow K^+p\pi^+\pi^-$ tussen 4 en 16 GeV/c (under the leading of F. Verbeure)

- The practical work for students attending the lectures of J. Lemonne and J. Sacton (Physique Générale Approfondie - 1ère licence en Sciences Physiques) has been organized by the scientific staff of the Institute as well as some optional practical work (80 h.) for students of the 3rd year in physics.

- In the frame of a Seminar on Elementary Particles organized by the Institute, the following lectures have been given :

D. SWANSON (ANL) : Study in the 12' hydrogen bubble chamber of inclusive gamma production in 12 GeV pp interactions

P. VILAIN (IIHE-ULB/VUB) : Deep inelastic lepton scattering - experimental situation.

M. FRIDMAN (Strasbourg) : New features in $\bar{p}d$ and $\bar{p}N$ interactions at 5.5 GeV/c.

W. GAJEWSKI (Warsaw) : Form factor of the π meson.

G. TRILLING (CERN, Berkeley) : Recent results from the SPEAR hadron production experiment.

P. VAN BINST (IIHE-ULB/VUB) : Image processing in bubble chamber physics using POLLY and the Brussels on-line system.

P. RENTON (IIHE-ULB/VUB) : Results of an experimental study of the K_{13}^+ decay modes.

- J. SACTON has been invited to give two lectures about neutrino physics at Louvain-la-Neuve and Mons. The titles were : "Interactions de neutrinos : leptons lourds, courants neutres ?" and "Rapport sur les résultats expérimentaux en physique du neutrino présentés à la Conférence de Londres".

- J. SACTON has been invited to give a lecture about "Hypernuclear physics and the Λ -N interaction : present status and outlook" at the International School of Elementary Particle Physics held at Basko-Polje - Makarska.

- D. JOHNSON has been invited to give two lectures in Warsaw on " K^-n elastic scattering at 4.5 GeV/c" and "Diffractive N^* ($I = 1/2$) production from the reaction $K^+ + p \rightarrow K^+ + \pi^+ + n$ at 16 GeV/c".

- F. VERBEURE has given an invited talk at the "Vth International Colloquium on Multiparticle Hadrodynamics - Eisenach/Leipzig June 1974" on "Multiplicity Distributions".

IV. SOFTWARE DEVELOPMENTS.

- Due to numerous changes in the operating systems of the two computers presently used by the laboratory (PDP-10 and CDC-6500), the activity of the programmers staff (G. Rousseau, R. Vandenbroucke

and G. Depiesse) was partly devoted to solving problems of data transfer and conversion. On the other hand, the program library was developed and enriched on both computers.

- In an effort to solve the problem of classifying publications, a bibliography program was developed (G. Wilquet) and used in several applications (classification of the preprints, the literature on very-high energy reactions...)

- The operation of the Polly automatic measurement machine gave rise to several applications :

1) The software used to measure film from conventional bubble chambers (such as the 30" Mura chamber) was continuously developed (P. Renton and P. Van Binst) in collaboration with the Polly groups at ANL and Toronto and a version allowing automatic scanning of such film for given event topologies was implemented.

2) The software was also adapted to deal with the special problems generated by the automatic measurement of the low contrast film from giant bubble chambers (P. Renton).

3) The geometrical reconstruction program TVGP has been implemented on the PDP-10 and adapted to the special problems encountered in the automatic measurement of film for the above experiments (J.H. Wickens). Versions of the kinematic fitting program GRIND for both experiments are now operating on the CDC-6500 (J.H. Wickens).

4) A new system has been developed (P. Renton, P. Van Binst and J.H. Wickens), using minimal road guidance information and permitting the automatic measurement, track-match, full-on line geometrical reconstruction and remeasurement guidance of events observed in giant bubble chambers (Argonne 12', ...).

- Several applications based on the HYDRA system were developed or implemented on the two computers :

- a geometry program for the Gargamelle chamber filled with CF_3Br or propane (D. Bertrand)
- a geometry program for the Rutherford 1.5 m chamber with TST (D. Bertrand)
- a kinematic program for the Mirabelle experiment (J.J. Dumont)
- a geometry program for the Argonne 12' chamber (D. Bertrand, P. Renton).

- The on-line data acquisition program for the SAAB scanning and

measuring devices has been written (G. Wilquet, H. Mulkens) and is presently being used by the neutrino experiment. The data may be passed to a geometry reconstruction program (D. Bertrand) to check the validity of the measurement.

- The on-line control of the PROSAM measuring device will be performed by a small PDP-8 computer which was purchased this year. The related software is being written (S. Tavernier). A program for steering the device by Mirabelle scanning data was developed (J.J. Dumont).

- The PDP-8 mini-computer will also be used to transfer the data produced by conventional measuring machines from paper tape to magnetic tape; the related software is being developed (G. Depiesse, G. Rousseau).

V. TECHNICAL WORK.

The activity of the technical staff in the laboratory may be described using the following subdivisions :

- (i) maintenance and break-down repairing
- (ii) construction of new devices
- (iii) study and development of projects.

Maintenance and break-down repairing constitute activities requiring a big effort because the machines used in the laboratory for analyzing bubble chamber pictures are highly diversified.

During the year 1974, the following constructions were completed :

- Three machines of the PICARD type. Those machines were entirely rebuilt in our workshop using the frame-work of existing machines of the PROLEPSE type.

- A new film transport device for the ENETRA I machine. The same machine was also equipped during 1974 with new electronic parts.

- One of the SAAB machines has been put on-line with the PDP-10 computer.

- Two universal wind-up machines for film rolls have been built in our workshop.

Other devices are actually under construction :

- An automatic machine, called PROSAM, designed for big bubble chamber films. This project presented at the Oxford Conference on Computer Scanning (see reference list) has been developed in the labo-

ratory and its realisation is being ensured by a commercial firm (AIDEL).

- The prototype of a scanning machine able to be used either with film of the BEBC and 12' chambers.
- The on-line devices for three SAAB machines.
- The readaption of the PRODOMO machine to film-types not foreseen in the original design.

The following projects are actually under development :

- The prototype of a scanning-premeasuring machine able to analyse Gargamelle and Mirabelle films.
- Several improvements in the hardware of the POLLY system.

VI. ATTENDANCE TO CONFERENCES, SCHOOLS AND MEETINGS.

A. Conferences.

- Colloque sur la physique du neutrino - Orsay (mars 1974) - P. Vilain.
- Oxford Conference on Computer Scanning (April 1974) - J. Heughebaert, J. Lemonne, P. Renton, P. Van Binst.
- Washington meeting of the American Physical Society (April 1974) Gh. Bertrand-Coremans and J. Sacton.
- International Conference on Neutrino Physics and Astrophysics (April 1974) - Gh. Bertrand-Coremans and J. Sacton.
- XVII International Conference on High Energy Physics - London (July 1974) - J. Sacton.
- Conference on Physics at Ultra High Energies - London (September 1974) - J. Lemonne, J.J. Dumont.
- Annual Symposium DECUS-Europe-Zurich (September 1974) - J.J. Dumont.
- Annual IFIP Congress - Stockholm (August 1974) - P. Van Binst.
- Vth International Colloquium on Multiparticle Hadrodynamics - Eisenach/Leipzig (June 1974) - F. Verbeure.

B. Schools.

- 1974 CERN School of Physics - Windermere (June 1974) - H. Mulkens.
- 1974 CERN School of Computing - Godoyssund (August 1974) - J.J. Dumont.

- Second Workshop on Weak Interactions with Very High Energy Beams Strobl (September 1974) - W. Van Doninck.
- Summer Student CERN School (August to October 1974) - M. Gijssen.
- DECUS Training Seminar - Zurich (September 1974) - P. Van Binst.
- Rutherford Laboratory Summer School (September 1974) - C. De Clercq.

C. Participation to data taking and scientific meetings.

- Data taking for the neutrino experiments at CERN
April 1974 : W. Van Doninck, Gh. Bertrand-Coremans
July 1974 : H. Mulkens
August 1974 : H. Mulkens
December 1974 : H. Mulkens, W. Van Doninck.
- Data taking for the 6.5 GeV/c K^-p experiment at Argonne National Laboratory
November 1974 : P. Peeters.
- Data taking for the Mirabelle experiment in Serpukhov
October 1974 : M. Gijssen.
- Meetings of the European K^+ Collaboration (nuclear emulsion) at Warsaw (May 1974) and London (November 1974) : D. Bertrand, J. Sacton, T. Tymieniecka.
- Meetings of the neutrino Collaboration at CERN and Ecole Polytechnique Paris : G. Bertrand-Coremans, H. Mulkens, J. Sacton, W. Van Doninck.
- Collaboration meetings of the K_{e3} , $K_{\mu 3}$ experiment (CERN) : D. Bertrand, J. Lemonne, P. Renton and P. Vilain.
- Collaboration meetings of the TST-slow K^- experiment :
London (March 1974) : D. Bertrand and M. Goosens
London (November 1974) : D. Bertrand and T. Tymieniecka
Birmingham (December 1974) : M. Goosens and G. Wilquet.
- Collaboration meetings of the K^-p 6.5 GeV/c experiment :
Boston (November 1974) : J. Lemonne and P. Peeters
Argonne (November 1974) : J. Lemonne and P. Peeters.
- Meetings of the Mirabelle Collaboration :
Saclay (May 1974) : J.J. Dumont
CERN (November 1974) : J.J. Dumont
- Different people have attended the meetings of the SPS, TC and Gargamelle User's Committee.

- Collaboration meeting of the K^+p 16 GeV/c experiment (CERN) :
D. Johnson, P. Peeters and F. Verbeure.
- Meetings for the preparation of the different proposals for experiments to be done at FNAL and CERN SPS :
Aachen (November 1974) : W. Van Doninck
Bergen (November 1974) : Gh. Bertrand-Coremans, W. Van Doninck
CERN : Gh. Bertrand-Coremans, J. Sacton
Strasbourg (November 1974) : J. Lemonne, J. Sacton
London (October 1974) : W. Van Doninck
Paris (December 1974) : J. Sacton.
- J. Lemonne has attended the CERN Council meetings as one of the Belgian delegates.

VII. LIST OF PUBLICATIONS.

- "High Energy Electronic Neutrino (ν_e) and Antineutrino ($\bar{\nu}_e$) Interactions"
H. EDEN..., G. BERTRAND-COREMANS, J. SACTON, W. VAN DONINCK, P. VILAIN et al
Proceedings of the 6th International Symposium on Electron and Photon Interactions at High Energies - Ed. H. Rollnik and W. Pfeil - Bonn (1973) p. 550.
- "Search for Elastic Muon-Neutrino Electron Scattering"
H. FAISSNER..., G. BERTRAND-COREMANS, J. LEMONNE, J. SACTON, W. VAN DONINCK, P. VILAIN et al
Proceedings of the 6th International Symposium on Electron and Photon Interactions at High Energies - Ed. H. Rollnik and W. Pfeil - Bonn (1973) p. 550.
- Observation of Neutrino-Like Interactions without Muon or Electron in the Gargamelle Neutrino Experiment"
... G. BERTRAND-COREMANS, J. SACTON, W. VAN DONINCK, P. VILAIN ...
Nuclear Physics B 73, 1, (1974).
- "Probabilité de Conversion des Hypérons Σ^- dans le Carbone"
J. SACTON, C. VANDER VELDE-WILQUET, J.H. WICKENS
Réunion de la Société Belge de Physique - Mons (juin 1974).
- "Further Investigation on the Events without Muons in the Gargamelle Neutrino Experiment" - Gargamelle Collaboration and
G. BERTRAND-COREMANS, J. SACTON, W. VAN DONINCK and P. VILAIN

Proceedings of the XVIIth International Conference on High Energy Physics - London (1974) p. IV-114.

- "A Search for the Reaction $\bar{\nu}_\mu + e^- \rightarrow e^- + \bar{\nu}_\mu$ " - Gargamelle Collab. G. BERTRAND-COREMANS, J. SACTON, W. VAN DONINCK and P. VILAIN

Proceedings of the XVIIth International Conference on High Energy Physics - London (1974) p. IV-121.

- "On the Decay Process ${}^8_{\Lambda}\text{Li} \rightarrow \pi^- + {}^4\text{He} + {}^4\text{He}$ "

... G. BERTRAND-COREMANS, D. KIELCZEWSKA, J. SACTON ...

Nuclear Physics B 74, 237, (1974).

- "On the Decay Mode ${}^7_{\Lambda}\text{Be} \rightarrow \pi^- + {}^1\text{H} + {}^1\text{H} + {}^1\text{H} + {}^4\text{He}$ "

... D. KIELCZEWSKA, J. SACTON...

- "Gargamelle Experiment"

G. BERTRAND-COREMANS, J. SACTON, W. VAN DONINCK, P. VILAIN

Proceedings of the XVIIth International Conference on High Energy Physics - London (1974) p. IV-95.

- "Hypernuclear Physics and the ΛN -Interaction : Present Status and Outlook"

J. SACTON

Bulletin of the Institute of High Energy Physics ULB-VUB - IIHE-74.4.

- "The Transverse Momentum Distribution and Statistical Models"

J.J. DUMONT and L. HEIKO

Bulletin of the Institute of High Energy Physics ULB-VUB - IIHE-74.1.

- "A Combined Analysis of the $K^+ \rightarrow \pi^0 e^+ \nu$ and $K^+ \rightarrow \pi^0 \mu^+ \nu$ Decay Modes"

39
(... D. BERTRAND, M. CSEJTHEY-BARTH, J. LEMONNE, P. RENTON, P. VILAIN... Proc. of XVII Int. Conf. H.E.P., London(1974) p. A 26 - Physics Letters 51 B, 393, (1974).

- "The Orbital Capture of K^- -Mesons in Liquid Helium"

R. ROOSEN, C. VANDER VELDE-WILQUET and J. GORDON

Bulletin of the Institute of High Energy Physics ULB-VUB - IIHE 74.2.

- "Implementation and First Performance of the Brussels Polly"

J. LEMONNE, P. RENTON, P. VAN BINST and J.H. WICKENS

Proceedings of the Oxford Conference on Computer Scanning (April 1974) Ed. by D.G. DAVIS and B.M. HAWES.

- "Diffractive N^* Production in Two-Prong Final States From K^+p Interactions at 16 GeV/c"

D. JOHNSON and P. PEETERS

Réunion de la Société Belge de Physique, Mons (juin 1974).

- "Etude Comparative des Distributions de Multiplicité dans les Collisions Hadron-Hadron"

E. DE WOLF, J.J. DUMONT and F. VERBEURE

Réunion de la Société Belge de Physique, Mons (juin 1974).

- "Quelques Aspects de la Production Inclusive des γ dans les Interactions K^+p à 32 GeV"

M. CSEJTHEY-BARTH, J.J. DUMONT and M. GIJSEN

Réunion de la Société Belge de Physique, Mons (juin 1974).

- "Etude Expérimentale de la Désintégration $K^+ \rightarrow \pi^+ \pi^0 \pi^0$ "

M. CSEJTHEY-BARTH, D. BERTRAND, P. RENTON and P. VILAIN

Réunion de la Société Belge de Physique, Mons (juin 1974).

- "The Orbital Capture of K^- -Mesons and Σ^- -Hyperons in Liquid Helium"

... R. ROOSEN, C. VANDER VELDE-WILQUET, J.H. WICKENS ...

Il Nuovo Cimento 24 A, 294, (1974).

- "Comparative Study of Charged Multiplicity Distributions"

E. DE WOLF, J.J. DUMONT and F. VERBEURE

Bulletin of the Institute of High Energy Physics ULB-VUB, IIHE 74.3; to be published in Nuclear Physics.

- "Simultaneous Production of K^{*0} (892) and Δ^{++} (1236) in the Reaction $K^+p \rightarrow K^+ \pi^+ \pi^- p$ from 4.3 to 5.0 GeV/c"

... G. DE JONGH, S. TAVERNIER ...

Nuclear Physics B 71, 52, (1974); preprint MPI-PAE/Exp. E1.31.

- "Backward Production of K^* (892) in the Reactions $K^+N \rightarrow K \pi N$ in Hydrogen and Deuterium for the Incident Momentum Range 3-5 GeV/c"

... G. DE JONGH, S. TAVERNIER ...

Nuclear Physics B 76, 189 (1974).

- "The Reaction $K^+d \rightarrow K^0 \pi^+ d$ at 4.6 GeV/c and the Effective Exchanged Trajectory for the Reactions $K^+d \rightarrow K^{*+}$ (892) d"

... G. DE JONGH, S. TAVERNIER ...

Nuclear Physics B 76, 333 (1974); preprint MPI-PAE/Exp. E1.30.

- "A Measurement of the K^* (1420) Decay Branching Ratios"

... G. DE JONGH, S. TAVERNIER ...

Nuclear Physics B 75, 47 (1974); preprint MPI-PAE/Exp. E1.73.

- "Coherent Production of Pions in K^+d Interactions at 4.6 GeV/c"

G. DE JONGH, S. TAVERNIER

CERN/D. Ph. II/PHYS. 74-41; submitted to Nuclear Physics B.

- "Description of Coherent Pion Production with a Generalized Veneziano Model"

S. TAVERNIER

Nuovo Cimento 24 A, 99 (1974).

- "Study of the Reaction $K^+n \rightarrow K^+ \pi^- p$ at 8.25 GeV/c"

... G. DE JONGH, S. TAVERNIER ...

Submitted to the XVIIth International Conference on High Energy Physics, London (1974).

- " K^+p Interactions near 3 GeV/c

(I) Elastic scattering : ANL/HEP 7419

(II) Baryon Resonance Production : ANL/HEP 7420"

... P. PEETERS ...

(work performed at the Argonne National Laboratory).

- "Multiplicity Distribution"

... F. VERBEURE ...

Proceedings of the 5th International Symposium on many particle Hydra-Dynamics, June 1974 - Eisenach - Leipzig, p. 347.

- "The Missing Mass Squared Dependence of the Average Charged Particle Multiplicity in the Reaction $K^+p \rightarrow K^0 X^{++}$ from 5-16 GeV/c"

... F. VERBEURE ...

Physics Letters 52 B, 375 (1974).