

INTER-UNIVERSITY INSTITUTE FOR HIGH ENERGIES
ULB - VUB; Brussels - Annual Report 1975.

J. LEMONNE and J. SACTON
(July 1976)

I. INTRODUCTION.

The physicists whose names are listed below have contributed to the different activities of the laboratory during the year 1975.

U L B.

D. Bertrand (chercheur IISN)
Gh. Bertrand-Coremans (Chef de travaux associé)
M. Csejthely-Barth (chercheur IISN - PNRs)
M. Dewit (boursier IRSIA; from October 1975)
J.J. Dumont (chercheur IISN)
J. Heughebaert (chercheur IISN - FNRS)
D. Johnson (chercheur IISN)
H. Mulkens (chercheur IISN)
J. Sacton (Professeur Associé)
T. Tymieniecka (chercheur IISN - untill december 74)
P. Van Binst (chercheur IISN - 3 months)
J. Wickens (chercheur IISN)
G. Wilquet (chercheur IISN)
C. Wilquet- Vander Velde (Assistant)

Note : During 1975, P. Vilain has been working at CERN (CERN fellowship) in the IISN group under the leading of J.P. Stroot.

V U B.

C. De Clercq (vorser IIKW)
E. De Vos (Assistent - October 1975)
M. Goossens (vorser IIKW)
M. Gysen (vorser IIKW)

J. Lemonne (Professor)
 P. Peeters (Werkleider)
 P. Renton (vorser IIKW)
 R. Roosen (Assistent)
 S. Tavernier (vorser IIKW)
 W. Van Doninck (vorser IIKW)
 G. Van Homwegen (vorser IIKW - October 1975)
 F. Verbeure, E. De Wolf and F. Vanden Boogaerde (from UIA) are working in close collaboration with the Institute.

The Scientific Committee of the Institute had a meeting on September 8, 1975 (chairman : J. Lemonne).

II. RESEARCH.

A. Nuclear Emulsion Studies.

A.1. Hypernuclear physics (J. Sacton, T. Tymieniecka)

The experimental program on hypernuclear physics, made in the frame of the European K^- Collaboration, is coming to an end. Using statistical weighting procedures a study of final state interactions has been made in the decay of different p-shell hypernuclei. Nuclear effects are clearly seen in most of these decays. A final report on this subject is being prepared.

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

The experiment has yielded a sample of 4639 τ^+ decays with a π^+ meson of kinetic energy between 1 and 30 MeV, representing a sevenfold increase in statistics as compared to the most significant data obtained so far concerning the low energy part of the π^+ meson spectrum. Great care has been taken to eliminate any systematic biases which could distort the spectrum. The data do not confirm the existence of a $\pi^0\pi^0$ resonant state with a mass near 400 MeV and a width of about 75 MeV which was suggested by some previous experiments. It is found that the strong corre-

lation existing between the first and second order parameters in the expansion of the τ' decay matrix element makes it unjustified to neglect the second order term even if its contribution is small.

This work was done in Collaboration with laboratories in Belgrade, Dublin, U.C. London and Warsaw.

A.3. Search for short-lived particles in the interactions of 300 GeV/c protons (G. Bertrand-Coremans and J. Sacton)

This work is made in collaboration with U.C. Dublin, U.C. London, Strasbourg, Roma and Warsaw. The emulsion stack was exposed at FNAL in June 1975. The area scanning of the plates for beam stars is in progress. Each star is scrutinized for the presence of secondary interactions or decays occurring within $< 200 \mu\text{m}$ from the primary vertex. One expects to analyze some 50 to 75.000 proton interactions for mid 1976.

B. Bubble Chamber Studies.

B.1. Cryogenic chambers.

B.1.1. K^+ p and K^+ d experiments in the 2m CERN HBC.

The fragmentation of the neutron in the reaction $K^+ n \rightarrow K^+ \pi^- p$ has been studied in the frame of the $K^+ d$ experiment at 8.25 GeV/c (S. Tavernier).

A search for N^* ($I = 1/2$) diffraction production in the final state ($K^+ \pi^+ n$) from $K^+ p$ interactions at 16 GeV/c has been initiated by Brussels in the frame of a collaboration grouping Birmingham, Brussels, CERN, Mons, Saclay and Serpukhov. The first results indicate that the neutral MM^2 , selecting fast K^+ 's in the final state, has a very large signal/noise ratio permitting a good separation of neutron events from the background (D. Johnson, P. Peeters and F. Verbeure).

B.1.2. $K^- d$ experiment at 4.6 GeV/c (C. Declercq, D. Johnson, J. Lemonne, P. Peeters, P. Renton, P. Van Binst, G. Van Homwegen and J.H. Wickens).

The technical work of this experiment, in which 1 prong spectator and 3 prongs (with or without spectator) events are measured on the automatic device Polly, is finished. Nearly 50.000 events have been measured in the aim of studying $K^- n$ and $K^- d$ elastic scattering as well as pion production processes. A final DST has been created for the elastic scattering processes under study and the physics analysis of these channels is in progress.

B.1.3. $K^- p$ 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, Kansas, Michigan State University and Tufts University.

Approximately 50% of the data taking of this experiment has been completed. Some 120.000 pictures have been scanned for 0 prong V, 3-, 4- and 4 prongs V topologies. Approximately 23.000 events were measured on Polly. The inclusive study of K^0 and Λ^0 (Σ^0) production mechanisms will be a first aim of the experiment which could be reached in the near future with preliminary data. Meanwhile the preparation of the study of the exclusive channels such as $K^- p \rightarrow K^- p \pi^+ \pi^-$ is continued and first attempts of a multidimensional separation of intermediate channels leading to this particular final state have been made.

B.1.4. $\bar{p}p$ experiment at 12 GeV/c in BEBC (D. Bertrand, D. Johnson, J. Lemonne, P. Renton, F. Van Den Bogaert and J. Wickens).

Collaboration : Brussels, CERN, I.C. London, Mons, Orsay).

An exposure of the Big European Bubble Chamber (BEBC) filled with hydrogen to a beam of 12 GeV/c antiprotons at the CERN-PS was completed at the end of May 1975. One quarter of the available film scanned at Mons and premeasured and measured in Brussels. More than 50% of this work has already been completed. The principal aim of this experiment is a study of narrow resonances in interactions in which a K_S^0 or Λ^0 (Σ^0) is emitted. The hope is to observe processes of the type $\bar{p}p \rightarrow D\bar{D}$, where D is a charmed

particle decaying in a neutral strange particle and pions. The inclusive study of K^0 or Λ^0 production will be an interesting by-product of this experiment.

B.1.5. K^+ meson interactions at 32 GeV/c in Mirabelle (M. Csejthey-Barth, J.J. Dumont, M. Gijsen, S. Tavernier, P. Van den Boogaerde and F. Verbeure).

This experiment is made in the frame of the French-Soviet Union and CERN-Soviet Union Collaborations. The distribution of the work between the IIHE and Mons is as follows :

scanning and premeasurements : IIHE

measurements : Mons

data handling (geometry and kinematics) : IIHE

DST : made in IIHE and checked in Mons.

Some 34 films, corresponding to ~ 10.000 events useful for physics, have been fully analysed. Preliminary data were presented at the Palermo Conference concerning :

- associated multiplicities in the inclusive reactions

$$K^+ + p \rightarrow K^0 + X^{++}$$

$$K^+ + p \rightarrow \pi^- + X^{+++}$$

- correlations between π^- pairs

- transverse momentum spectra in the reactions

$$K^+ + p \rightarrow K^0 + X$$

$$K^+ + p \rightarrow \pi^- + X$$

- diffraction dissociation of the kaon

- study of some exclusive reactions (2, 4 and 6 bodies in the final state).

B.1.6. T.S.T. Experiments (Track Sensitive Target in the Rutherford Chamber).

1) Neutral channels in the $K^- p$ interactions at rest (IIHE-UCL Collaboration - D. Bertrand, M. Goossens, T. Tymieniecka, G. Wilquet)

The double scanning and measurements are under process. A modified version of HYDRA-geometry has been adapted to the TST technique and ~ 4000 events have been processed so far. Magnetic field and liquid density calibrations are investigated. An event simulation program taking account of the very special features of the TST experiment, will soon, provide a wide sample of fake events to be analysed by HYDRA-kinematics.

2) $\Sigma^+ \pi^- / \Sigma^- \pi^+$ ratio in $K^- p$ interactions at rest.

(IIHE-UCL Collaboration - D. Bertrand, M. Goossens, T. Tymieniecka, G. Van Homwegen, G. Wilquet).

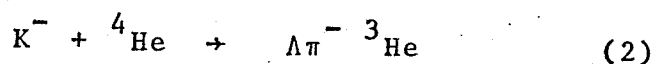
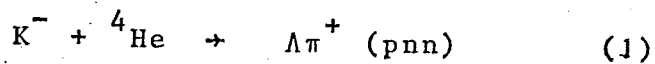
The ratio $\gamma = \frac{\Sigma^+ \pi^-}{\Sigma^- \pi^+}$ has been measured both in nuclear emulsion and in a hydrogen bubble chamber experiment, leading to conflicting results. A new value of this parameter can be obtained with the present film with an accuracy comparable to the previous estimates. The scanning of the pictures is under way.

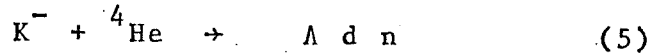
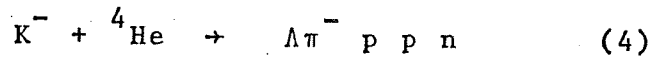
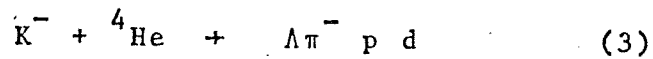
3) Neutral channels in the $K^- p$ interactions between 180 and 450 MeV/c. (IIHE-UCL - Durham - Birmingham Collaboration - D. Bertrand, M. Goossens, T. Tymieniecka, G. Wilquet).

Only the analysis of the 225000 frames taken with the metal frame target has been undertaken so far by the collaboration except for some exploratory scan in the film taken with the all perspex target.

B.1.7. K^- meson absorptions at rest in liquid helium.

In this experiment, K^- meson absorptions at rest in liquid helium leading to a Λ particle in the final state are studied. In total 117.000 pictures have been scanned and about 8000 events have been measured. These events can be divided in the following channels :





From reaction (1), which must proceed through conversion of a Σ^- hyperon, the average Σ^- hyperon cascade time can be determined. This analysis has been terminated and the results are published. Reactions (2), (3), (4) permit to study the importance and the mechanism of the Σ^- hyperon conversion present in these channels. Reaction (3) also allows to investigate the Λp invariant mass distribution. The final state (5) results from the absorption of a K^- meson on two nucleons and therefore gives information about the multinucleonic reaction mechanism. The analysis of these reactions is in a terminal phase.

B.2. Heavy liquid chambers.

ν ($\bar{\nu}$) interactions in Gargamelle (G. Bertrand-Coremans, M. Dewit, H. Mulken, J. Sacton, W. Van Doninck).

These studies are performed in the frame of the Gargamelle Collaboration

(a) the freon experiment

- During this year, emphasis has been put on the study of the following topics :

- (i) $\bar{\nu}_\mu e^- \rightarrow \bar{\nu}_\mu e^-$ scattering
- (ii) strange particle production both in neutral and charged current ν and $\bar{\nu}$ interactions
- (iii) one π^0 production by weak neutral currents in neutrino and antineutrino reactions.

- More statistics have been accumulated in the aim of refining our inclusive study of the $\nu(\bar{\nu})$ interactions.

- In the course of the study of strange particle production an event has been found which could result from the production and subsequent decay of a charmed hadron according to the sequence:

$$\nu_{\mu} + \text{nucleus} \rightarrow \mu^{-} + C + \text{hadrons}$$

$$\downarrow e^{+} + (S = -1 \text{ state}) + \nu_e$$

This finding made it possible to obtain one week extra run in the ν beam using the booster. About one half of the available film has been scanned and 2 additional candidates have been observed. A careful study of the background strongly indicates the existence of a new type of interaction leading to a charged lepton pair correlated with a strange particle in the final state.

- Limits for the mass and lifetime of long lived heavy neutral leptons and cross section for their production have been determined from a re-analysis of the 1971 CERN neutrino beam dump experiment

(b) the propane experiment.

The data taking has been completed in Spring 1975. Scanning and measuring of the film are in progress. First priority is given to the analysis of the one pion channels.

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

- C. Vander Velde-Wilquet has obtained the degree of Ph. D. after submission of an original dissertation intituled :

"Etude expérimentale des interactions des mésons K^{-} au repos dans le propane".

- Two students spent the academic year in the Institute to prepare their "mémoire".

(i) M. Dewit : Contribution à l'étude expérimentale des caractéristiques des interactions de neutrinos et d'antineutrinos sans muon dans l'état final.

(ii) G. Van Homwegen : Elastische K^{-} n verstrooiing bij 4.5 GeV/c.

- 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.
- J. Lemonne has been invited to participate to the 1st Workshop on Experimental High Energy Physics (Erice - Italy) where he presented a talk on aspects of the SPS-experimental program with the by European bubble chamber BEBC.
- J. Sacton has given a review of the results obtained in neutrino physics by the Gargamelle Collaboration at the CERN Track Chamber Committee.
- J. Sacton has presented to the CERN Track Chamber Committee the Gargamelle proposal to search for charmed hadrons in neutrino interactions.
- J. Sacton has been invited to give a lecture at the University of Warsaw on "New particles and anomalies in high energy neutrino interactions".
- G. Bertrand-Coremans has been invited to give a lecture at the University of Warsaw on "Neutral currents in ν interactions in Gargamelle".
- G. Bertrand-Coremans has given three invited talks at the IUPAP Conference "Neutrino 75" held at Balaton fured :
 - "Search for elastic muon antineutrino electron scattering"
 - "Study of one π^0 production by weak neutral currents in ν and $\bar{\nu}$ reactions"
 - "Strange particle production and charmed particle search in the Gargamelle $\nu\bar{\nu}$ experiment".
- In the frame of a Seminar on Elementary Particles organized by the Institute, the following lectures have been given
 - G. London : "Is there an exotic baryon with strangeness + 1"
 - J. Sacton : "New particles as reported at the 1975 SLAC lepton photon Symposium".

L. Redei : "Incoherent particle emission and cluster production".

- A series of internal seminars has been organized starting from october 1975 (in charge : M. Goossens); the speakers were D. Bertrand, J. Sacton, C. Vander Velde-Wilquet (2x) and S. Tavernier.

IV. SOFTWARE DEVELOPMENTS.

1) Software to be used on the CDC's of the Brussels Universities :

- In the new configuration (CDC 6500 + CDC 6600) which will be available in 1976, another operating system will be used. Therefore, the existing programs were modified in order to meet the requirements of this system and some problems concerning the translation of tapes were solved.

- A CERN software package for plotting histograms and curves in two and three dimensions was implemented (M. Gijssen).

- Some improvements were applied to existing production programs for the TST experiment (G. Rousseau, G. Depiesse, D. Bertrand), the Mirabelle experiment (J.J. Dumont) and the $K^- p$ experiment (J. Wickens, P. Peeters).

- New versions of the HYDRA system and applications were implemented (D. Bertrand, E. De Vos). A version of the kinematic program for the TST experiment was developed (D. Bertrand).

2) Software to be used on the PDP 10 of the laboratory.

- The new versions of the HYDRA system were also implemented on the PDP 10 (D. Bertrand, E. De Vos)

- An effort was made to optimize the utilization of the computer by implementing new system programs, overlaying existing application programs, using new communication facilities between different programs, writing several routines in machine language

and faster data acquisition routines (R. VdBroucke, P. Van Binst, J.J. Dumont).

- The software of the Polly measurement machine was modified in order to allow measurement of BEBC film (P. Renton).

- A new version of the TVGP geometrical reconstruction program suited to geant bubble chambers (BEBC, 12 foot) was developed (J. Wickens). The on-line reconstruction was made possible by linking this program to the Polly software.

- While the on-line data acquisition program for the Gargamelle experiment is now working simultaneously for two SAAB tables (G. Wilquet, H. Mulkens), a new program was developed for the Mirabelle experiment (M. Gysen). It allows on-line scanning and premeasuring with automatic checking of the results.

- During the absence of P. Van Binst (Military Service), J.J. Dumont acted as system manager of the DEC-10 computer.

V. TECHNICAL WORK

The following construction work has been completed during 1975 :

- The construction of a new front pannel for Polly providing improved optical (direct projection) and electronical (computer generated) images. This work is part of the general adaptation of Polly to the specific requirements of BEBC film.

- The prototype of a new scanning table (BEBC, 12') allowing both conventional and life-size image projection.

- The performances of the semi-automatic machine PROSAM, which was built by an outside firm, have not yet met our expectations. Further improvements of this device will have to be considered.

- The design of two new on-line measuring systems was started, based (i) on the acquisition of a SWEEPNIK automatic measuring machine and (ii) on the connection of the new BEBC tables to a mini-computer. Two DEC PDP-11/40 systems were ordered for these purposes.

Apart from the usual and time-consuming maintenance tasks, our workshops have also undertaken the construction of two Gargamelle-Mirabelle scanning and premeasurement tables.

VI. ATTENDANCE TO CONFERENCES, SCHOOLS AND MEETINGS.

A. Conferences.

- Colloque sur la physique du neutrino à très haute énergie - Paris : Gh. Bertrand-Coremans, J. Sacton and W. Van Doninck.
- Neutrino 75 -Balatonfured : Gh. Bertrand-Coremans and W. Van Doninck.
- International Symposium on lepton and photon interactions at high energy - Stanford : J. Sacton.
- Semi-Annual Decus Symposium - Londres : J.J. Dumont
- International Conference on High Energy Physics - Palermo : D. Bertrand, E. De Wolf and S. Tavernier.
- International symposium on antiproton interactions - Loma Koli : P. Renton.
- Dixième Rencontre de Moriond - Meribel les Allues : W. Van Doninck.
- 1st Workshop on Experimental High Energy Physics - Erice : J. Lemonne.

B. Schools.

- 1975 JINR-CERN School of Physics - Alushta : J.J. Dumont and M. Goossens.
- International School of Elementary Particle Physics - Basko-Polje : H. Mulken.
- Ettore Majorana Summer School in Subnuclear Physics - Erice : D. Johnson.
- 1975 CERN Summer Student Course- Geneva : M. Dewit
- 1975 Rutherford Summer School on Elementary Particle Physics : G. Van Homwegen.

C. Participation to data taking and scientific meetings.

- Data taking for the neutrino experiments at CERN
février 1975 : G. Bertrand-Coremans, W. Van Doninck.
july 1975 : W. Van Doninck

august 1975 : G. Bertrand-Coremans

december 1975 : H. Mulkens

- Data taking for the 6.5 GeV/c K^- experiment at Argonne
 january 1975 : D. Johnson
 november 1975 : C. De Clercq and P. Peeters
- Data taking for the 12 GeV/c \bar{p} experiment at CERN
 april 1975 : D. Bertrand, D. Johnson, J. Lemonne, J.H. Wickens
 may 1975 : D. Johnson, J. Lemonne, P. Renton, F. Van Den Bogaer
- Processing at CERN of the 300 GeV/c proton stack exposed at FNAL
 june 1975 : C. Donis, J. Sacton and G. Wilquet
- Different people have attended the meetings of SPS, TC, BEBC and Gargamelle Users Committees at CERN as well as Collaboration meetings in London, Belgrade, Paris, CERN, Orsay.
- J. Lemonne has attended the CERN council meetings (June and December) as one of the Belgian Delegates.

VII. LIST OF PUBLICATIONS.

- (1) The non mesonic to π^- mesonic decay ratio and Λ -neutron stimulation fraction for p-shell hypernuclei.
 A. Montwill.... G. Coremans-Bertrand and J. Sacton
 Nucl. Phys. A 234 (1974) 413.
- (2) On the binding energy values and excited states of some $A > 10$ hypernuclei
 T. Cantwell... G. Coremans-Bertrand, J. Sacton, T. Tyminiecka;
 Nucl. Phys. A 236 (1974) 445.
- (3) A determination of the spin of the hypernucleus $^{12}_{\Lambda}B$
 D. Kielczewska, J. Sacton,...
 Nucl. Phys. A 238 (1975) 437.

- (4) Measurement of decay branching ratios for the $^4_{\Lambda}\text{He}$ hypernucleus
G. Keyes, J. Sacton, J.H. Wickens...
IIHE 75/3; to be published in Nuovo Cimento
- (5) The Conversion probability and emission ratio of charged Σ hyperons following K^- meson capture at rest in carbon
C. Vander Velde-Wilquet, G.S. Keyes, J. Sacton, J.H. Wickens...
Nucl. Phys. A 241 (1975) 511.
- (6) Experimental study of structure functions and sum rules in charge changing interactions of neutrinos and antineutrinos on nucleons.
H. Deden,... G. Bertrand-Coremans, J. Sacton, W. Van Doninck, P. Vilain,...
Nucl. Phys. B 85 (1975) 269.
- (7) Elastic neutrino and antineutrino interactions
Gargamelle Collaboration (... G. Bertrand-Coremans, H. Mulkens J. Sacton and W. Van Doninck)
La Physique du Neutrino à Haute Energie - Paris 1975 p.349.
- (8) Preliminary result on ν -neutron and ν -proton charged current cross sections ratio
Gargamelle Collaboration (... G. Bertrand-Coremans, H. Mulkens J. Sacton and W. Van Doninck)
La Physique du Neutrino à Haute Energie - Paris 1975 p.327
- (9) Neutral pion production by weak neutral currents in neutrino and antineutrino reactions
Gargamelle Collaboration (... G. Bertrand-Coremans, H. Mulkens J. Sacton and W. Van Doninck)
La Physique du Neutrino à Haute Energie - Paris 1975 p. 225
and "Neutrino 75" Balatonfured 1975 vol. I p.156
and Phys. Lett. 59 B (1975) 485 (F.J. Hasert et al.)
- (10) Search for elastic muon antineutrino-electron scattering
Gargamelle Collaboration (...G. Bertrand-Coremans, H. Mulkens, J. Sacton, W. Van Doninck)

- La Physique du Neutrino à Haute Energie - Paris 1975 p.257
 and "Neutrino 75" Balatonfured 1975 vol. I p.6
 and Réunion de la Société Belge de Physique - Anvers 1975.
- (11) Strange Particle production and charmed particle search in
 the Gargamelle neutrino experiment
 Gargamelle Collaboration (... G. Bertrand-Coremans, M. Goossens,
 H. Mulkens, J. Sacton, W. Van Doninck and P. Vilain..) La Physique
 du Neutrino à Haute Energie - Paris 1975 p.173
 and "Neutrino 75" Balatonfured 1975 vol. II p.80
 and Réunion de la Société Belge de Physique - Anvers 1975
 and Phys. Lett. 58 B (1975) 361 (H. Deden et al.)
- (12) A note on the measurement of γ ray and π^0 meson energies in
 Gargamelle filled with heavy freon
 H. Mulkens
 IIHE 75/2
- (13) Implementation and performance of the Brussels Polly system
 C. De Clercq, D. Johnson, R. Goorens, J. Lemonne, P. Peeters,
 P. Renton, P. Van Binst and J.H. Wickens
 IIHE 75/1
- (14) Automatic measurement of bubble chamber film using the Brussels
 Polly III system
 C. De Clercq, D. Johnson, R. Goorens, J. Lemonne, P. Peeters,
 P. Renton, P. Van Binst and J.H. Wickens
 Réunion de la Société Belge de Physique - Anvers 1975.
- (15) A parton like model for strong interactions at high energies
 S. Tavernier
 Réunion de la Société Belge de Physique - Anvers 1975; to be
 published in Nucl. Phys.
- (16) The $\Lambda\Lambda$ and E^-p mass spectra produced by 2.2 GeV/c K^- inter-
 actions on nuclei
 G. Wilquet, ...
 Rutherford Lab. 75/001
 and Physics Lett. 57 B (1975) 97

- (17) A spin parity analysis of the $K^+K^+K^-$ system produced in the reaction $K^+p \rightarrow K^+K^+K^-p$

... D. Johnson, P. Peeters, F. Verbeure,...

Phys. Lett. 55 B (1975) 117

- (18) Phenomenological comparison of inelastic electron-proton scattering with reaction $K^+p \rightarrow K^0 + \text{anything}$ at 5, 8.2 and 16 GeV/c

... E. De Wolf and D. Johnson...

CERN / D. Ph II / Phys. 75.18 ; to be published in Phys. Lett

- (19) Inclusive Δ^{++} production in K^+p interactions at 8.2 and 16 GeV/c

... E. De Wolf, D. Johnson, P. Peeters, F. Verbeure.....

IIHE 75/4 ; to be published in Nucl. Phys.

- (20) Neutral K, Λ and $\bar{\Lambda}$ production in K^-p and K^+p interactions at 32 GeV/c

P. Beillièrè, ... J.J. Dumont, ...

Nucl. Phys. B 90 (1975) 20

- (21) Comparative study of charged multiplicity distributions

E. De Wolf, J.J. Dumont and F. Verbeure

Nucl. Phys. B 87 (1975) 325

- (22) Production of γ rays in K^-p and K^+p interactions at 32 GeV/c

P. Beillièrè, ... M. Gijsen, ...

Nucl. Phys. B 91 (1975) 219

- (23) A study of the Semi-Leptonic decays of K^+ mesons

D. Bertrand, M. Csejthey-Barth, J. Lemonne, P. Renton and P. Vilain

Nucl. Phys. B 89 (1975) 210

- (24) S. Tavernier et al.

The Reaction $K^+d \rightarrow K^+ \pi^+ \pi^-$ at 4.6 GeV/c

Nucl. Phys. B 91 189 (75).