

# INTER-UNIVERSITY INSTITUTE FOR HIGH ENERGIES

## ULB-VUB, BRUSSELS - ANNUAL REPORT 1985.

J. LEMONNE and J. SACTON  
January 1986

### I. INTRODUCTION.

The physicists whose names are listed below have contributed to the different activities of the laboratory during the year 1985.

#### U.L.B.

M. Barth (maitre de recherche FNRS)  
D. Bertrand (chercheur qualifié FNRS)  
G. Bertrand-Coremans (chef de travaux associé)  
M. De Jode (boursier IRSIA - since octobre 1985)  
P. Marage (chercheur ARC)  
J. Sacton (professeur associé)  
N. Shams El Din (stagiaire - doctorant)  
P. Van Binst (chargé de cours associé)  
C. Vander Velde (chef de travaux associé)  
P. Vilain (chercheur qualifié FNRS)  
J. Wickens (chercheur IISN)  
G. Wilquet (chercheur qualifié FNRS)  
S. Willocq (doctorant - since October 1985)

#### V.U.B.

H. Cobbaert (Vorsers IIKW)  
C. De Clercq-Vincent (logistiek medewerker IIKW)  
K. De Winter (assistent - since October 1985)  
D. Geiregat (vorsers IIKW)  
D. Johnson (vorsers IIKW - since December 1985)  
J. Lemonne (gewoon hoogleraar)  
J. Moreels (vorsers IIKW)  
R. Roosen (bevoegdverklaard navorser NFWO)  
S. Tavernier (onderzoeksleider NFWO)  
R. Vandenbroucke-Tassin (informaticus IIKW)  
W. Van Doninck (bevoegdverklaard navorser NFWO)  
L. Van hamme (vorsers IIKW; aspirant NFWO since October 1985)  
B. Vonck (vorsers IIKW)

F. Verbeure, M. Breusers (since November 1985), A. De Roeck, E. De Wolf, J. Gaudaen, M. Van Immerseel and L. Verluyten (since October 1985) from the UIA are working in close collaboration with the Institute. Early in the year, A. Michalowska joined the UIA group for a period of 3 months, on leave of absence from the Institute for Nuclear Physics, Krakow; she joined the group definitely on 1 December 1985. M. Van Immerseel and J. Gaudaen left the group on 1 September 1985.

## II. RESEARCH ACTIVITIES.

### II.1. Neutrino Physics.

#### II.1.1. Neutrino and antineutrino interactions in BEBC filled with a heavy $H_2/Ne$ mixture.

(D. Bertrand, P. Marage and J. Sacton; WA59 Collaboration : Athens, Bari, Birmingham, Brussels, CERN, Cracow, Ecole Polytechnique - Palaiseau, I.C. London, U.C. London, Munich, Oxford, Rutherford, Saclay, Stockholm).

The studies of (i) dilepton production ( $\mu\mu$  and  $\mu e$ ) in charged current neutrino and antineutrino interactions, (ii) coherent single  $\pi$  meson production in charged current antineutrino interactions and (iii) scale breaking effects in high  $z$   $\pi^-$  meson production have been finalized.

Asymmetries have been observed in the distribution of the aximuthal angle  $\phi$  about the current direction of leading pions in semi-inclusive neutrino and antineutrino charged current interactions ("cos  $\phi$ " effects).

The  $(\bar{\nu})$  interaction cross section ratio on protons and Ne nuclei have been measured to be  $0.659 \pm 0.015 \pm 0.009$  (neutrinos) and  $1.425 \pm 0.030 \pm 0.039$  (antineutrinos) by comparing the results of the WA59 and of the WA21 collaborations obtained in BEBC filled respectively with neon and hydrogen, exposed to similar wide band  $(\bar{\nu})$  beams.

The comparison of neutrino interactions on Ne and  $D_2$ , from the data of the WA59 and of the WA25 collaborations respectively, using BEBC exposed to a similar wide band beam, shows an x-dependence similar to the antineutrino case previously reported, confirming evidence for the "EMC effect".

Work is still in progress on several subjects :

- (i) measurement of the nucleon structure functions,
- (ii) study of the hadron formation time, by comparing the production of fast  $\pi^-$  in Ne and in  $H_2$ ,
- (iii) search for quark innerbremsstrahlung and study of muon innerbremsstrahlung,
- (iv) coherent production of  $\rho^-$  and  $A_1$  mesons,
- (v) gluon fragmentation effects in hadron production,
- (vi) study of the  $\pi^0$  meson fragmentation.

### II.1.2. Neutrino and antineutrino interactions in the 15' bubble chamber, exposed to the Tevatron neutrino beam.

(M. Barth, E. De Wolf, P. Marage, J. Moreels, J. Sacton, L. Verluysen and S. Willocq; E632 Collaboration : Birmingham, Brussels, CERN, I.C. London, Munich, Oxford, Rutherford, Saclay, Berkeley, Fermilab, Hawaii, Illinois I.T., Rutgers, Tufts).

Data have been taken at Fermilab from March to August using the 15' bubble chamber filled with an heavy Ne/H<sub>2</sub> mixture. With a proton beam of 800 GeV, the neutrino energy spectrum peaks around 120 GeV and extends up to 400 GeV. A total of 150000 pictures has been taken, corresponding to about 15000 charged current interactions. The chamber was viewed by 3 conventional cameras and one high resolution 200  $\mu$ m camera looking at 10 % of the chamber volume. In addition, good quality holograms were taken in an even more restricted volume of about 1 m<sup>3</sup>.

About 75 % of the film in Brussels (12000 pictures) has been scanned so far, and the primary vertices are being measured for identifying those events to be analyzed with the holographic replay machines.

The events visible in the field of the high resolution camera have been scanned for the presence of a close- in secondary vertex due to the decay of short-lived particles; no candidate were found in Brussels.

The events with 2- and 4-prongs are being measured for the study of coherent interactions (search for coherent production of F and F<sup>\*</sup> mesons).

A special scan has been initiated for multilepton candidates.

### II.1.3. Study of neutrino and antineutrino scattering on electrons.

(G. Bertrand-Coremans, K. De Winter, D. Geiregat, P. Vilain and G. Wilquet; CHARM II or WA79 Collaboration : Brussels, CERN, Hambourg, Louvain-La-Neuve, Naples, Rome).

The aim of the experiment is the accurate determination of the electroweak mixing angle from the measurement of the cross section ratio of neutrino-electron and antineutrino-electron scattering. The detector is a 620 ton fine-grain calorimeter followed by a muon spectrometer. The calorimeter consists of 440 units, each composed of a glass plate and a plane of streamer tubes with 1 cm wire spacing. The digital read-out from the wires and the analog read-out of the 2 cm wide cathode strips orthogonal to the wires allow a precise measurement of the shower direction and energy. Analysis of the shower profile will be used to separate electromagnetic from hadronic showers. Every 6th unit

is followed by a scintillator plane equipped for  $dE/dx$  measurement.

The muon spectrometer consists of six magnets interspaced with 8 planes of drift chambers and 1 plane of streamer tubes.

The installation of the detector is actively going on in order to be ready for the first data taking period foreseen from June to September 86.

Due to some hardware failure of the read-out system, the first test run which took place last August was not very successful. Since then, tests with cosmic rays are regularly performed to monitor the performances of the installed part of the detector.

Besides the construction of some electronic equipment (described in section V), the IIHE physicists have contributed mainly to various software developments. In particular, a detector monitoring task which will allow on-line a permanent control of the quality of the recorded data has been developed. Misbehaviours such as noisy or dead streamer tubes or fluctuations in the signals from the scintillators and the cathode strips are detected and indicated to the operator on shift.

An off-line software has been written to disentangle the signals due to the muon from those of the associated hadronic shower. The tracking of the muon in the calorimeter is first performed in the regions where it is sufficiently isolated from the hadronic shower. It is, then, extrapolated to the vertex and its contribution in each crossed plane is calculated and subtracted from the total signal. At the end of this so called "cleaning" procedure, the shower direction and energy may be computed in the same way as for neutral current hadronic events.

To help the data analysis, it is foreseen to use at the IIHE a graphic station display controlled by a Microvax which will allow interactive event display.

## II.2. Hadron physics.

### II.2.1. Hadronic interactions in EHS with $K^+$ and $\pi^+$ meson beams of 250 GeV/c.

(A. De Roeck, E. de Wolf, A.B. Michalowska, M. Van Immerseel and F. Verbeure; NA22 Collaboration : Aachen, Antwerp-Brussels, Berlin, Helsinki, Krakow, Moscow State University, Nijmegen, Rio de Janeiro, Serpukhov, Warsaw, Yerevan).

The experimental set-up consisted of the European Hybrid Spectrometer with an hydrogen filled rapid cycling bubble chamber RCBC, as vertex and slow particle detector. The chamber was equipped with an Al and an Au foil wherein about 5 % of the interactions occur. A total of 700000 pictures with 220000

interactions are to be analysed. At the IIHE, all events of part A of the experiment are on DST (5000  $K^+p$  events, 15000  $\pi^+p$  events, 400 events on nuclei).

For part B, the scanning and the measurements of  $K^+$  meson interactions were completed on the full sample. The  $\pi^+$  events in the Al and Au foils are still to be measured. First results on inclusive production of charged particles and  $\pi^0$  mesons have been obtained.

## II.2.2 Study of $p\bar{p}$ interactions at the CERN Collider.

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(C.De Clercq, J. Gaudaen, D. Johnson, L. Van hamme and G. Wilquet; UA5 Collaboration : Bonn, Brussels, Cambridge, CERN, Stockholm).

The UA5 collaboration has concentrated its effort (a) on the final analysis, with full statistics, of the data collected in 1982 at  $\sqrt{s} = 540$  GeV and (b) on new data taking, in spring 1985, and preliminary data analysis at the world record energy of  $\sqrt{s} = 900$  GeV.

An original study of the energy dependence, in the range from 10 to 540 GeV, of the moments of the multiplicity distribution in terms of fits to negative binomial distributions shows a clear departure from KNO scaling as  $\sqrt{s}$  increases and a remarkably smooth evolution of the two distribution parameters with energy.

Data collection in 1985 has been achieved with the collider being run in pulsed mode, with two plateaus at  $\sqrt{s} = 900$  and 200 GeV, representing about 15 and 30 % of the cycle respectively. A total of about 100000 events have been registered, mainly at the two plateau-energies, with various trigger conditions allowing to record almost 100 % of the non-single diffractive interactions, and a large fraction of the single diffractive interactions, with a reduced background contamination. Many improvements have been implemented in the experimental set-up, both to cope with these peculiar run conditions and to improve the quality and the reliability of the data. Preliminary results have been obtained concerning :

(i) an estimation of the non-single diffractive and the total cross sections at 200 and 900 GeV, from a measurement of their ratios. Both cross-sections are seen to increase with no sign of saturation,

(ii) a measurement of the multiplicity distributions at both energies, fitted to negative binomials, with parameters extrapolating well those obtained at 540 GeV and at lower energies, therefore establishing a clear confirmation of the KNO scaling violation,

(iii) a confirmation of the Feynmann scaling violation in the plateau region of the pseudorapidity distribution, shown by an increase of the plateau height with  $\sqrt{s}$  following an  $a + b \ln s$

law. Conversely, an impressive scaling invariance to within 5-10 % is observed in the fragmentation region, in the energy range from 63 to 900 GeV.

### II.2.3. Charmed particle production by 360 GeV/c $\pi^-$ mesons and 400 GeV/c p in a rapid cycling hydrogen bubble chamber.

(G. Bertrand-Coremans ( $\pi^-$  part only), K. De Winter, J. Lemonne, P. Vilain, B. Vonck and J. Wickens; NA27 Collaboration : Aachen, Bombay, Brussels, CERN, Duke, Genova, Japan, Liverpool, Madrid, Mons, Oxford, Padova, Paris, Collège de France, Rome, Rutgers, Rutherford, Serpukhov, Stockholm, Strasbourg, Tennessee, Torino, Trieste, Vienna, Zeuthen).

The small high resolution bubble chamber LEBC was exposed in front of the European Hybrid Spectrometer in 1982 to a 360 GeV/c  $\pi^-$  meson beam and in 1984 to a 400 GeV/c p beam. These runs have provided 850000 and 2300000 pictures respectively which were double scanned for decay topologies.

The selection of charmed particle decays was then performed on the basis of an accurate measurement of the events on the HPD machine of Strasbourg followed by the track reconstruction in the downstream spectrometer. The data sample presently available consists of 183 charm decays from the  $\pi^-$  run (final statistics) and 150 from the p run (about 40 % of the final sample) corresponding to a sensitivity of 15.8 and 13.7 events per  $\mu\text{b}$ , respectively.

Most of the identified decays are D mesons allowing to determine with a reasonable accuracy their lifetime and production cross sections. A more detailed analysis of the differential  $x_F$  and  $p_T$  distributions and of the correlations between the members of the DD pairs has also been performed. The data compare well with predictions from various phenomenological models of charm quark production but are still not accurate enough to select among them.

No uniquely identified F meson has been observed in the  $\pi^-$  data. A search<sub>+</sub> for a F meson signal based on the identification of  $K^\pm$  mesons by ISIS also led to a negative result. An upper limit of  $750 \pm 200$  nb was set on the F meson production cross section.

A few examples of  $\Lambda_c^+$  baryon decays have been observed but more work is needed to estimate the selection efficiency and kinematical biases.

The measurement of the proton film is expected to be completed in March 86 and the analysis a few months later. At the IIHE the film scanning was completed in July.

#### II.2.4. Direct observation, in emulsion, of the decay of beauty particles selected by their muonic decay.

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(M Barth, D. Bertrand, G. Bertrand-Coremans and R. Roosen; WA75 Collaboration : Bari, Brussels, CERN, Dublin, Funabashi, Gifu, Kariya, U.C. London, Nagoya, Roma, Torino, Utsunomiya, Yokohama).

This hybrid emulsion counter experiment aims at the direct observation of beauty particles produced by 360 GeV/c  $\pi^-$  mesons and selected by the detection of high  $p_T$  muons. About 30 % of the total amount of data ( $3 \times 10^8$  interactions in 80 litres of emulsion) have been analysed. One example of the associated production of a pair of beauty particles  $B^-$  and  $\bar{B}^0$  has been observed in the emulsion as well as their subsequent decay into charmed particles. Two negative muons were identified and their momenta measured in the downstream muon spectrometer. One muon has a transverse momentum  $p_T$  of 1.9 GeV/c and is associated with the  $B^-$  decay; the other with a  $p_T$  of 0.45 GeV/c is associated with a charmed particle originating from the  $\bar{B}^0$  decay. The flight times of the two beauty particles are estimated to be respectively  $(0.8 \pm 0.1) 10^{-13}$  s and  $(5^{+2}_{-1}) 10^{-13}$  s. Alternative interpretations of this event have a negligible probability.

Assuming an A dependence of the cross-section and taking account of the acceptance of the apparatus and the efficiency of both the trigger and the analysis chain, this one event corresponds to a cross-section for beauty particle hadroproduction of  $\sim 5$  nb.

#### II.2.5. Study of the production of beauty particles using a muon spectrometer and a hadron-calorimeter.

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(H. Cobbaert and R. Roosen; WA78 Collaboration : Bari, Brussels, CERN, U.C. London, Rome, Turin).

The basic idea of the experiment is to estimate the production cross sections of beauty particles via their semi-leptonic decay mode by a simultaneous measurement of the total energy (calorimeter) and decay muon energy (muon spectrometer). After the detection of a  $B\bar{B}$ -candidate in the WA75 experiment it was decided to have a first scan through the  $7 \times 10^{11}$  triggers imposing severe cuts ( $E_{\text{miss}} > 50$  GeV) to find a signal. This analysis requires a huge computer time and is now underway.

The same setup also allows to study the A-dependence of the  $C\bar{C}$ -cross sections by using different materials for the front part of the calorimeter. The '84 data have shown that, in order to estimate correctly the background in this study, data using different calorimeter configurations are essential. Most of these data taking runs have been performed in '85, the analysis being in progress.

Clearly, prior to both the analysis mentioned, a perfect understanding of the calorimeter behaviour in high rate conditions is imperative. This calorimeter analysis has been finalised this year leading to interesting results about high rate performance and the uranium compensation effect in uranium calorimetry.

### **II.2.6. Charm production in pp interactions at 800 GeV.**

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(J. Lemonne, B. Vonck and J. Wickens; E743 Collaboration : Aachen, Berlin, Brussels, CERN, Duke, Fermilab, Kansas, Michigan (Ann Arbor), MSU, Mons, Notre Dame, Bombay, Vanderbilt, Vienna).

This experiment completes the preceeding NA16 and NA27 charm studies. Its main aim is to measure differential and total cross-sections for the production of charmed particles in pp interactions at an incident momentum of 800 GeV/c. For this purpose the bubble chamber LEBE and elements of the EHS spectrometer previously used at CERN in the EHS set-up have been transported to Fermilab to adapt the existing MPS-spectrometer to the special needs of charmed particle searches. Moreover, the identification of  $K^\pm$  mesons within a large momentum domain, essential for the identification of the charmed particle decays, has been made possible by the construction and installation in the MPS of two specially designed Cerenkov counters.

The run took place from May to August. A total of 1.2 million pictures were taken containing  $\sim 0.5$  million pp interactions. The analysis of the film has started in fall.

### **II.3. Study of $e^+e^-$ annihilation at LEP.**

(D. Bertrand, M. Breusers, G. De Clercq, M. De Jode, J. Lemonne, J. Sacton, S. Tavernier, C. Vander Velde, W. Van Doninck, F. Verbeure, J. Wickens; DELPHI Collaboration : Ames-Iowa, Athens, Athens-NTU, Belgium, Bergen, CERN, Collège de France, Copenhagen, Cracow, Dubna, Ecole Polytechnique-Palaiseau, Helsinki, INFN-Bologna, INFN-Genova, INFN-Milano, INFN-Padua, INFN-Roma, INFN-Trieste, INFN-Torino, Karlsruhe, LAL-Orsay, Liverpool, Lund, NIKHEF-Amsterdam, Orsay, Oslo, Oxford, Paris-LPNHE, Rutherford, Saclay, Santander, Serpukhov, Stockholm, Strasbourg, Uppsala, Valencia, Vienna, Warsaw, Wuppertal).

The collaboration between Belgium (IIHE/ULB-VUB, Mons, UIA) and the laboratories of Oxford and Rutherford on the muon part of the DELPHI detector proceeds as planned.

The DELPHI muon chamber system is designed to select muons by recording two spatial points on the tracks of those charged particles which penetrate the hadron calorimeter over its full depth. Coordinates are measured by drift chambers, a first layer of which is inserted in the iron at a depth of approximately 0,2 m, a second layer being fixed on the outer surface of the calorimeter.



The barrel chambers will be operated in the proportional mode and constructed by Oxford and R.A.L. The endcap chambers will be operated in the limited streamer mode and constructed by the Belgian teams. The drift fields are sufficiently uniform to achieve 1 mm accuracy in the direction perpendicular to the anode wire. Measurement of coordinates along the anode wire are performed with wound solenoidal type delay lines which also function as central field shaping electrodes. The high pulses recorded in the limited streamer mode have allowed the design of very slow (inverse velocity  $\sim 620$  ns/m) and accurate (spatial resolution  $\sim 4$  mm) lines for the endcap chambers. In the barrel of DELPHI, the chambers are arranged in two staggered double layers, with 4 points measured for each track. The delay-lines provide z-measurements with  $\sim 1$  cm accuracy in this case.

The endcap chambers will be assembled into 4 x 4 quadrants, each quadrant being square (4.6 m x 4.6 m) and containing 22 + 22 drift tubes crossed at right angles so that time measurements in both directions provide 1 mm accuracy. In this case, the delay-line will often only be used to resolve ambiguities.

The design of these endcap detectors is essentially the result of a study made by the Belgian groups involved and the use of the limited streamer mode drifting electrons over distances up to 10 cm is a technical novelty.

All orders for the components necessary for the construction of the endcap quadrants have been placed in industry. Their assembly in the workshops of the IIHE and of the University of Mons has started. Special tooling which was made or at least designed "in house" is extensively used for this purpose. One quadrant is almost completed and ready for testing in a special designed test rig using cosmic rays and steered by a PDP11-computer. The production of a second quadrant is under way.

In parallel to the construction work, studies are still being made of :

- i) The safest and most appropriate gas mixture to be used in the final set-up
- ii) The central data read-out and detector control electronics
- iii) An integrated muon trigger utilising both the barrel and endcap muon chambers, as well as the signals from the time of flight counters and the hadron calorimeter
- iv) Event simulation and muon tracking algorithms
- v) Graphical devices and software procedures designed to unravel the complicated track patterns expected to be recorded in the DELPHI-detector
- vi) General purpose software for DELPHI.

### III. TEACHING ACTIVITIES AND SEMINARS.

- The practical work for students attending the lectures of **J. Lemonne** and **J. Sacton** (3rd and 4th year 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.
- **G. Bertrand** has deputized J. Sacton for his lectures (30 h) on "Introduction to Elementary Particle Physics".
- **S. Tavernier** has deputized J. Lemonne for his lectures (15 h) on "Detektie van ionizerende stralingen".
- **P. Van Binst** has given the following lectures :  
 "Notions pratiques d'informatique" (15 h - Faculté des Sciences)  
 "Introduction à l'informatique" (30 h - Licence en Informatique et Sciences Humaines - Nivelles)  
 "Informatique pratique" (60 h - Licence en Informatique et Sciences Humaines - Nivelles)  
 "Télématique" (15 h - Licence en Informatique et Sciences Humaines - Nivelles)
- **R. Vandenbroucke** has deputized J. Lemonne for 30 h of "programmatische oefeningen".
- **C. Vander Velde** has contributed to "Travaux pratiques de Physique Générale" (135 h; 1ère candidature Institut Solvay).
- **K. De Winter** has contributed to the "Practica van de kandidaturen Natuurkunde".

The following "mémoires", "licentiaat verhandelingen" and "travaux de fin d'études" have been made at the IIHE :

"Etude de l'implantation des facilités de reprises dans un protocole de transferts de fichiers" by **F. Degraeve** (ULB - licence en informatique)

"Studie van enkele hadronische vervalkanalen van gecharmeerde D-mesonen" by **K. De Winter** (VUB - licentie in natuurkundige wetenschappen)

"Interactions cohérentes diffractives, du type courant chargé, de neutrinos et d'antineutrinos sur noyaux de néon" by **P. Queeckers** (ULB - licence en sciences physiques)

"Lecture de la seconde coordonnée dans des chambres à dérive fonctionnant en mode à dard" by **F. Rasio** and **H. Waelbroeck** (ULB - grade d'ingénieur civil physicien)

"Bijdrage tot het testen van muondetectiekamers met behulp van een CAMAC uitleessysteem" by **J. Vlaeyen** (VUB - licentie informatika)

"Production de deux leptons de même charge par neutrinos et mélange  $D^0-\bar{D}^0$ " by **S. Willocq** (ULB - licence en sciences physiques); codirection avec J.M. Frère du Pool de Physique ULB.

- **S. Tavernier** has obtained the degree of "geaggregeerde voor het hoge onderwijs" (Charmed particle production in hadronic interactions).
- **M. Van Immerseel** (UIA) has obtained her PhD (D meson production in  $\pi^-p$  and  $pp$  interactions at 360 GeV/c).
- **P. Marage** won the A. Lagarrigue prize at the Erice International School of Subnuclear Physics.
- **L. Van hamme** won the prize of the Belgische Natuurkundige Vereniging for his "licentiaatsverhandeling" intitled "Bijdrage tot de studie van de vreemde-deeltjesproduktie in  $pp$  wisselwerkingen by  $\sqrt{s} = 540$  GeV"

The following seminars have been presented by members of the IIHE :

#### **G. Bertrand**

- . Selected topics from the Kyoto Conference (IIHE)
- . First direct observation of BB production in the WA75 experiment (IIHE)

#### **P. Marage**

- . Short review of the  $p\bar{p}$  results presented at the Bari Conference (IIHE)

#### **J. Sacton**

- . Dileptons from neutrino and antineutrino interactions (University of Bonn)
- . ECFA - Realisations récentes et projets (LAL-Orsay)
- . The Activities of ECFA (Washington HEPAP meeting)
- . ECFA : Its origin and present activities (IIHE)

#### **P. Van Binst**

- . Software projects implementation in a small High Energy Physics laboratory (6th Summer School on Computing Techniques in Physics, Nove Mesto na Morave)
- . Informatique et Bureautique, aspects techniques et enjeux professionnels (école Funck)
- . Evaluation récente des systèmes Videotex, perspectives a court et moyen termes (Ministère de la Fonction Publique)
- . Evaluation à long terme des techniques et services télématiques à domicile (Université du 3ème âge - Charleroi)

#### **W. Van Doninck**

- . Drift chambers operated in the limited streamer mode (KEK - Tsukuba)
- . The DELPHI muon detector (Rhein Westphalische Technische Hochschule, Aachen)

#### **L. Van hamme**

- . Recent results from the UA5 experiment (IIHE).

In the framework of the Seminars on Elementary Particles organised by **P. Vilain** at the IIHE, the following lectures were given :

- . J. Dumarchez (from Université Pierre et Marie Curie)  
"Neutrino decays and oscillations : results from the CERN PS-191 experiment"
- . D. Favart (from Université Catholique de Louvain-La'Neuve)  
"Observation of a narrow  $K\bar{K}$  state in the radiative decay of the  $J/\psi$ "
- . J.M. Frère (from ULB)  
"The problem of CP violation"
- . C. Matteuzzi (from CERN - Geneva)  
"Search for unconventional particles at PEP"
- . B. Michalowska (from University of Krakow)  
"What can we learn from particle production in hadron-nucleus collisions at high energies ?"
- . M. Pohl (from ETH-Zurich)  
"Heavy flavour production at PETRA"
- . R.D. Schaffer (from Columbia)  
"A search for like sign dilepton production by neutrinos in the 15 FT bubble chamber"
- . K. Soop (from IBM - Belgium)  
"Picture structuring in man-machine dialogs"
- . B. Vignon (from Université de Grenoble)  
"Neutrino oscillations : results from Le Bugey experiment".
- . J. Lemonne gave a popular talk at Bruges (Lakenhalle) on  
"Fysica van de elementaire deeltjes".
- . G. Bertrand, P. Marage and P. Vilain have organized a series of seminars on Particle Physics for students of the Athénée A. Max
- . P. Van Binst has organized a meeting on High Speed Data Communications by Satellite with the participation of J. Prevost (DPhPE, Saclay) and H. Fallour and J. Radureau (NADIR project, INRIA). He also organized a meeting of the Groupe de Travail (HELIOS)
- . In her capacity of chairperson of the DECUS BELUX Network Special Interest Group, R. Vandenbroucke has organized two meetings on "Local Area Network" and "Videotex".

#### IV. COMPUTER MATTERS.

##### IV.1. Data processing and data communications.

In the laboratory itself, the main DECsystem20 computer was used for batch processing, interactive and real-time work, as

well as acting as a host system for a number of mini and microcomputers supporting various measuring machines and data acquisition devices. These smaller computers include DEC PDP-11, LSI-11, microVAX II, DECmate II word processor, Apple II, Lisa, MacIntosh, etc. Another PDP-11, previously used to control a SWEEPNIK film reader, is now used in the frame of the DELPHI developments; it has been equipped with supplementary terminals and RK05 disks and has also seen its older core memory replaced by a larger MOS one, which is a beneficial operation due to the lower maintenance cost of the new hardware. The older DECsystem10 which was used to control the POLLY film reader, has been definitively switched off.

The main DECsystem20 was also linked, via a communication front-end processor, to the Belgian and international public packet-switched networks. This facility was very heavily used by the members of the laboratory, to obtain remote terminal access to different computers at CERN and in many other places (Oxford, Cambridge, Stockholm, Bonn, Fermilab, ...) as well as to transfer files and exchange electronic mail. In particular, through the use of the "GIFT" protocol converter at CERN, the IIHE can exchange data with all the machines located on CERNET. In Belgium, a collaboration with our colleagues at UIA in Antwerp has allowed them to connect their VAX computer to the public DCS network and to implement the necessary "high level" communication protocols, so that full communication was possible between Antwerp and Brussels; this facility was used daily by the UIA team.

The DECsystem20 has seen a much needed increase in its disk configuration, from one to three units (each a 200 Megabytes DEC PR06), bringing the total capacity to 600 Megabytes.

At the ULB-VUB Computer Centre, the existing CDC CYBER 750 has been supplemented by a ULB PRIME 9950 computer which is now also being used by the IIHE. This machine is also connected to the DCS network and the laboratory is collaborating with the ULB to implement file transfer capabilities on that computer.

On all machines, at the IIHE and at the Computer Centre, new system and application software is regularly implemented and developed, by G. Depiesse, G. Rousseau, R. Vandenbroucke and W. Van Droogenbroeck, as well as by most physicists and engineers. The networking activities are managed and realized by P. Van Binst and R. Vandenbroucke. A lot of logistic activities related to computing and networking are taken on by G. Depiesse and G. Rousseau. These two persons, together with R. Vandenbroucke and W. Van Droogenbroeck, provide a lot of help and assistance to users of the IIHE and Computer Centre facilities, both inside and outside of the laboratory.

During 1985, a research and development project named HELIOS-B has been defined by P. Van Binst in collaboration with a research group in Saclay (France), aiming at the future availability of high-speed data transmission facilities at the IIHE. The first main goal is to achieve 2 Megabits/second data transmission between CERN and Brussels, by making use of a channel of the TELECOM-I satellite. This project has been submitted to the ULB, the VUB, the RTT, the Commission of the European Communities and a number of private companies. By the

end of the year, discussions were well advanced and the ULB and the VUB had already decided to allocate personnel and financial resources to the project which will be officially launched in January 1986.

#### IV.2. High performance graphics station development.

This development was realised by D. Bertrand, M. De Jode, J.P. Dewulf and Ch. Wastiels within the framework of an ARC project. Its aim is to equip the laboratory with high resolution and high performance graphics stations which will be indispensable for the analysis of the results of the LEP DELPHI experiment. During this year a prototype station was finalised with the following characteristics : Resolution : 1180 x 880 pixels; Color : 16 (4 x 128 kbytes memory planes) and Speed : 800 ns/pixel.

The remote controller is a Motorola 68000 at 8 MHz in a VME system and the graphics controller is a NEC  $\mu$ PD 7220.

The evaluation of the market of the existing high resolution stations has been made resulting in the ordering of a MEGATEK Whizzard 3375.

#### V. TECHNICAL AND ADMINISTRATION WORK.

The members of the workshop staff were : R. De Wolf, J.P. Dewulf, L. Etienne, R. Gindroz, R. Goorens, E. Lievens, E. Putteman, R. Ruidant, J. Van Bastelaere, G. Van Beek, J. Van Begin, R. Vanderhaegen, L. Van Lancker, J. Van Vaerenberg, G. Vincent and Ch. Wastiels. S. Tavernier was in charge of the general coordination of the workshop and L. Etienne and G. Van Beek were in charge of the organisation of the electronical and mechanical parts respectively.

During 1985 the workshop of the IIHE has been thoroughly reorganised in order to cope with the new situation created by the decision to build the muon detector for the DELPHI experiment. A technical project of such a scale had never been undertaken before in the laboratory. Appropriate working areas had to be and were found : the VUB has placed at our disposal a clean room of 260 m<sup>2</sup> area equipped with an overhead crane runway. In this room a 30 m<sup>2</sup> mounting table (on loan from Aachen) which is flat to within 100  $\mu$ m has been installed. Because of the size and weight of some of the components of the detector special working tables, storage tables and racks and handling tools had to be built in house.

A large number of identical units having to be produced, semi-automatic special purpose tools were designed and built : a cutting machine, a milling machine and a winding machine for the delay line construction. To make the work fast and efficient a series of other small tools were made.

As a result, the first of the 17 quadrants (one spare) of the DELPHI muon detector was completed at the end of the year. This was achieved thanks to the additional collaboration of

various members of the IIHE scanning team. J. De Bruyne, A. De Coster, J. De Schutter, C. Dumont, R. Pins and M.L. Ronsmans.

Besides the DELPHI experiment, the other important activities of the workshop have been :

- (i) maintenance of the equipment of the laboratory
- (ii) construction of parts of the camera of the HOLRED machine built at RAL for replaying holograms from the Fermilab 15' bubble chamber (J. Moreels, R. Ruidant, J. Van Bastelaere, L. Van Lancker, G. Vincent)
- (iii) construction of a graphic display controlling machine (D. Bertrand, J.P. Dewulf and Ch. Wastiels)
- (iv) final preparation of 500 printed circuit boards (memory cards) for the WA79 experiment. These boards were manufactured by MBLE; the work done in the laboratory consisted in mounting about 100 electronic components per board, soldering and testing. The soldering was facilitated by the use of a wave soldering machine loaned by the "Dienst Elektronica (Prof. O. Steenhout)". This work was performed under the leading of J.P. Dewulf by a team of scanners : A. De Coster, C. Donis, C. Dumont, M.P. Kips and D. Luybaert.
- (v) In the frame of the CHARM II experiment, J.P. Dewulf was in charge of the design and construction of an analog test pulser to check the continuity and linearity of the analog chain which measures the charges induced by the associated streamer tubes.
- (vi) J.P. Dewulf, G. Van Beek and G. Wilquet has been responsible for the maintenance, the upgrade and the running of the optics system of the UA5 experiment during the preparation and the data taking periods. J.P. Dewulf and G. Wilquet have contributed to the design and the construction of CAMAC modules used for the on-line control of the data acquisition system.

In performing the experiments which are summarized in the present report, the physicists have benefited from the efficient work of the scanning and measuring teams of the laboratory which consisted of : C. Carlier, J. De Bruyne, A. De Coster-Vancouwenberghe, M. Delasorte, J. De Schutter-Gevers, M. de Schutter, Cl. Donis, C. Dumont, M.P. Galloy-Kips, Ch. Garnier-Stoffen, M. Goeman, D. Legrand-Mahaux, J. Liesen, M. Pins, R. Pins, D. Pirnay-Pauwels, M.L. Ronsmans, J. Thys-Raynard, M. Van Mechelen-Paulus, L. Vermeersch-Polderman, A. Vermijlen-Pels.

The secretarial work was accomplished by R. Alluyn-Lecluse and M. Garnier-Van Doninck. Cl. Vorstermans-Hennebert took care of the library.

## VI. REPRESENTATION IN COUNCILS AND COMMITTEES.

The Advisory Scientific Committee of the IIHE met on December 1985. Those present were : **F. Grard** (chairman; U.E. Mons), **J. Lemonne** (VUB), **D.H. Perkins** (University of Oxford - U.K.), **J. Sacton** (ULB), **J.P. Stroot** (Belgian IISN group at CERN) and **F. Verbeure** (U.I. Antwerpen).

**J. Lemonne** has been one of the Belgian representatives in the CERN Council. **J. Lemonne**, **J. Sacton** and **F. Verbeure** were members of the Scientific Committee "High Energies" of the IIKW-IISN and of the Belgian Selection Committee of CERN-Fellows.

In his capacity of chairman of the European Committee for Future Accelerators, **J. Sacton** has organized and chaired the various meetings of the Committee during 85. He attended

- two ICFA meetings in Bombay and Brussels
- the meetings of the CERN Scientific Policy Committee, Finance Committee, Committee of Council and Council
- two meetings of the Extended Scientific Committee at DESY
- two meetings of the Working Group on the Scientific and Technological Long Term Future of CERN, chaired by C. Rubbia
- four meetings of the European Computing Coordinating Committee at CERN and DESY
- two meetings of the Board of the HEPP division of the European Physical Society at Petit-Lancy
- an extraordinary meeting of the High Energy Physics Advisory Panel of the U.S. Department of Energy at Washington
- an hearing of the Task Force on Science Policy of the Committee on Science and Technology of the U.S. House of Representatives at Washington
- two meetings of the European delegation to the Working Group of High Energy Particle Physics of the Versailles Working Group on Technology, Growth and Employment at Geneva.

**J. Sacton** has acted as external advisor on a Search Committee to consider candidates for indefinite appointment as research physicists in the E.P. Division at CERN.

**P. Van Binst** was the Secretary of the Board of the Computational Group of the European Physical Society. He was a member of the ECFA Working Group on Data Processing Standards, Subgroup 5, "Links and Networks", of the Board of DECUS-BELUX and of the European DECUS Council. He was chairman of the DECUS "At large" chapter. He was a member of the ABUT/BVT (Association belge des utilisateurs des télécommunications), of the CBUT (Commission Bruxelloise des Utilisateurs des télécommunications), of the Comité Informatique de l'Institut Belge de Normalisation, of the International Standardization Organisation of the Groupe de Travail HELIOS and of the Scientific Advisory Committee of the 7th Summer School on Computing Techniques in Physics (to be held



in Prague in 1987). In the frame of a Commission of the European Communities he has worked on the evaluation of the Esprit Information Exchange System proposals.

**R. Vandenbroucke** was a member of the ABUT/BVT, of the Board of DECUS- BELUX; she was chairperson of the DECUS-BELUX network special interest group and of the DECUS-BELUX Symposium planning committee.

**J. Lemonne** has represented the belgian groups in the Board of DELPHI.

**J. Wickens** was a member of the DELPHI Software Coordinating Panel. He was coordinator of the group concerned with the specification and production of the Data Analysis Software for the experiment.

**C. Vander Velde** has represented the muon endcap detector group in the Trigger group of the DELPHI collaboration.

## VII. ATTENDANCE TO CONFERENCES, SCHOOLS AND WORKSHOPS.

- . International Europhysics Conference on High Energy Physics - Bari  
J. Gaudaen, P. Marage, J. Moreels, J. Sacton
- . 1985 International Symposium on Lepton and Photon Interactions at High Energies - Kyoto  
Gh. Bertrand, W. Van Doninck
- . 16th International Symposium on Multiparticle Dynamics - Kiryat Anavim  
E. De Wolf, F. Verbeure, G. Wilquet
- . Physics in Collisions 5 - Autun  
J. Lemonne, C. Vander Velde, S. Tavernier
- . 10th International Conference on Weak Interactions - Savonlinna  
D. Bertrand
- . 5th Topical Workshop on proton-antiproton Collider Physics - St Vincent-Aosta  
C. De Clercq
- . 13th International Conference on Solid State Nuclear Track Detectors - Rome  
J. Sacton
- . Workshop on Heavy quarks, flavour mixing and CP violation - Moriond  
P. Vilain, B. Vonck
- . Workshop on Physics in the 90's at the Sp $\bar{p}$ S Collider - Zinal  
S. Tavernier
- . Computing in High Energy Physics - Amsterdam  
P. Van Binst, R. Vandenbroucke

- . European Networkshop - Luxembourg  
P. Van Binst, R. Vandenbroucke
- . DECUS Holland Symposium - Amsterdam  
P. Van Binst, R. Vandenbroucke
- . DECUS-BELUX Symposium - Bruxelles  
P. Van Binst, R. Vandenbroucke
- . DECUS Europe Symposium - Cannes  
P. Van Binst, R. Vandenbroucke
- . Fastbus Software Workshop - CERN  
C. De Clercq
- . VME bus in Physics - CERN  
C. De Clercq
- . IBM Academic and Research Conference - Monte-Carlo  
P. Van Binst
- . Satellite Multiservice System Symposium - Rotterdam  
P. Van Binst
- . L'Ergonomie en informatique - Nivelles  
P. Van Binst
- . ISO, technical committee 97, subgroup 6 - Paris  
P. Van Binst
- . Journées bilan du projet pilote NADIR - Versailles  
P. Van Binst
- . "T-dag : Burotica" organized by the Vlaamse Deelregering  
R. Vandenbroucke
- . "Bureautique" Seminar organized by BULL  
R. Vandenbroucke
- . 6th Summer School on Computing Techniques in Physics - Nove Mesto na Morave  
P. Van Binst (as lectures)
- . Joint CERN-JINR School for Physics - Urbino  
A. De Roeck, L. Van Hamme
- . International School on Subnuclear Physics - Erice  
P. Marage
- . International School of Elementary Particle Physics - Kupari Dubrovnik  
D. Geiregat

# VIII. LIST OF PUBLICATIONS AND CONTRIBUTIONS TO CONFERENCES.

## VIII.1. Publications.

"Dilepton and Trilepton Production by Antineutrinos and Neutrinos in Neon"

G. Gerbier ... D. Bertrand, P. Marage, J. Sacton ...

Z. Phys. C - Particles and Fields 29 - 15 - 1985

"Direct Observation of the Decay of Beauty Particles into Charm Particles"

J.P. Albanese ... M. Barth, D. Bertrand, G. Bertrand, R. Roosen ...

Physics Letters 158B - 186 - 1985

"A Search for F Production in 360 GeV/c  $\pi^-p$  Interactions"

M. Aguilar-Benitez ... P. Vilain, B. Vonck, J. Wickens ...

Physics Letters 156B - 444 - 1985

"Inclusive Properties of D-Mesons produced in 360 GeV/c  $\pi^-p$  Interactions"

M. Aguilar-Benitez ... P. Vilain, B. Vonck, J. Wickens ...

Physics Letters 161B - 400 - 1985

" $D\bar{D}$  Correlations in 360 GeV/c  $\pi^-p$  Interactions"

M. Aguilar-Benitez ... P. Vilain, B. Vonck ...

Physics Letters 160B - 404 - 1985

"Observation of  $\Xi^-$ -Production in  $\bar{p}p$  Interactions at 540 GeV CMS Energy"

G.J. Alner ... C. De Clercq, J. Gaudaen, D. Johnson, L. Van hamme, G. Wilquet ...

Physics Letters 151B - 309 - 1985

"An Investigation of Multiplicity Distributions in Different Pseudorapidity Intervals in  $\bar{p}p$  Reactions at a CMS Energy of 540 GeV"

G.J. Alner ... C. De Clercq, J. Gaudaen, M. Gijsen, D. Johnson, L. Van hamme, G. Wilquet ...

Physics Letters 160B - 193 - 1985

"Kaon Production in  $\bar{p}p$  Reactions at a Centre-of-Mass Energy of 540 GeV"

G.J. Alner ... C. De Clercq, J. Gaudaen, M. Gijsen, D. Johnson, L. Van hamme, G. Wilquet ...

Nuclear Physics B258 - 505 - 1985

"A New Empirical Regularity for Multiplicity Distributions in place of KNO Scaling"

G.J. Alner ... C. De Clercq, J. Gaudaen, M. Gijsen, D. Johnson, L. Van hamme, G. Wilquet ...

Physics Letters 160B - 199 - 1985

"Bijdrage tot de studie van de vreemde deeltjesproductie in  $\bar{p}p$  wisselwerkingen bij  $\sqrt{s} = 540$  GeV"

L. Van hamme

Physicalia Magazine 7 - 47 - 1985

"Reactions with Inclusive Production of two Neutral Kaons in  $K^+p$  Interactions at 32 GeV/c"

I. Ajinenko ... E. De Wolf ...  
Yad. Fysika 41 - 338 - 1985

"A Study of Inclusive  $\phi$ -Mesons Production associated with other Particles in  $K^+p$  Interactions at 32 GeV/c" (+)

I. Ajinenko ... E. De Wolf ...  
Sov. J. Nucl. Phys. 39 - 914 - 1984

"Inclusive Production of Baryon Resonances in  $K^+p$  Interactions at 32 GeV/c" (+)

V. Kniazev ... E. De Wolf ...  
Sov. J. Nucl. Phys. 40 - 927 - 1984

"Inclusive Production of  $K_s^0\Lambda$ ,  $K_s^0\bar{\Lambda}$  and  $\Lambda\bar{\Lambda}$  Pairs in  $K^+p$  Interactions at 32 GeV/c"

I. Ajinenko ... E. De Wolf ...  
Yad. Fysika 41 - 925 - 1985

"Final-State Interactions in the Decay of the Hypernucleus  $^9_\Lambda\text{Li}$  and a Reappraisal of the Binding Energies of  $A=9$  Hypernuclei"

J. Pniewski ... G. Bertrand, J. Sacton ...  
Nuclear Physics A443 - 685 - 1985

"Measurement of Small Angle Antiproton-Proton and Proton-Proton Elastic Scattering at the CERN Intersecting Storage Rings"

N. Amos ... C. Vander Velde-Wilquet ...  
Nuclear Physics B262 - 689 - 1985

"Electron Capture in the Presence of Strong Magnetic Fields in Astrophysical Sites"

P. Marage  
Astron. Astrophys. 151 - 198 - 1985

"Long-Printed Circuit Delay Lines"

L. Etienne, R. Goorens, J. Lemonne, H. Waelbroeck ...  
Nucl. Instr. and Meth. 241A - 429 - 1985

"L'Institut Interuniversitaire des Hautes Energies (ULB-VUB) et ses Rapports avec le CERN"

J. Sacton  
Nouvelles de la Science et des Technologies, Vol. 3 no 2 - 47 - 1985.

"Proceedings of the Europhysics Conference on Software Engineering, Methods and Tools in Computational Physics, Brussels, 1984" Computer Physics Communications vol. 38 no 2 - 1985 - Ed. by G. Diercksen and P. Van Binst

"Track and Event Management Package - User Manual"

D. Bertrand and L. Pape  
DELPHI Note 85/88 PROG 31

## VIII.2. Contribution to Conferences.

### a. Presented by members of the IIHE.

- . **E. De Wolf**  
"Beam and target fragmentation in soft hadron collisions"  
Proceedings of the XVth International Symposium on Multiparticle Dynamics, Lund p. 2, 1984 - also Bulletin IIHE 84/05
- . **L. Etienne** (DELPHI)  
"Design of the front end electronics to read-out the forward muon identifier of the DELPHI experiment at LEP"  
(Annual Meeting of the Belgian Physical Society - Antwerp)
- . **J. Gaudaen** (UA5 Collaboration)  
"Multiplicity distributions and KNO scaling violation : new UA5 results"  
(International Europhysics Conference on High Energy Physics, Bari)
- . **D. Geiregat** (NA25 Collaboration)  
"Determination of the total charm production cross section in pN interactions at 200 and 360 GeV/c"  
(Annual Meeting of the Belgian Physical Society - Antwerp)
- . **P. Marage** (WA59 Collaboration)  
"Coherent pion production by antineutrinos and PCAC"  
(European High Energy Physics Conference, Bari)  
also Bulletin of the IIHE 85/03
- . **J. Moreels** (WA24 Collaboration)  
"The study of the charged pion ratios in the current fragmentation region of neutrino and antineutrino neutral current interactions on protons"  
(Annual Meeting of the Belgian Physical Society - Antwerp)
- . **J. Sacton**  
"The use of nuclear emulsion in hybrid detectors for High Energy Physics"  
(Solid State Nuclear Track Detectors Conference at Rome)  
also Bulletin of the IIHE 85/04
- . **P. Van Binst**  
"Possible solutions for HEP networking in Europe"  
(Conference on Computing in High Energy Physics, Amsterdam)
- . **R. Vandenbroucke** (and P. Van Binst)  
"Wide area networking for High Energy Physics in Brussels and Antwerp"  
(Conference on Computing in High Energy Physics, Amsterdam)
- . **W. Van Doninck** (DELPHI Collaboration)  
"Prototype results of the muon chambers"  
(DELPHI 85-72-Gen-35, p. 153 (1985))

. **F. Verbeure**

"Particle production in  $K^+p$  interactions"  
(Proceedings of the XXIIth International Conference on High Energy Physics Leipzig, p. 302, 1984)

**b. Others.**  
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- . Internal muon Bremsstrahlung in neutrino, antineutrino Ne interactions  
WA59 Collaboration  
1985 International Symposium on Lepton and Photon Interactions at High Energies - Kyoto
- . Hadron production in neutrino-Ne interactions in BEBC  
WA59 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . A comparison of the total cross section in  $H_2$  and Ne for  $\nu_\mu$  and  $\bar{\nu}_\mu$  charged current interactions between 20 and 300 GeV  $\mu$   
WA59 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Dilepton and trilepton production by neutrinos and antineutrinos in Ne  
WA59 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Direct observation of the production and decay of beauty particles  
WA75 Collaboration  
International Europhysics Conference on High Energy Physics - Bari  
Solid State Nuclear Track Detector Conference - Rome
- . Properties of neutral D-mesons produced in a 360 GeV/c  $\pi^-p$  experiment  
NA27 Collaboration  
New Particle Production XIX Rencontre de Moriond - La Plagne 1984, p. 277
- . Production and decay of charmed particles in 360 GeV/c  $\pi^-p$  interactions  
NA27 Collaboration  
New Particle Production XIX Rencontre de Moriond - La Plagne 1984, p. 267
- . Decay properties of D-mesons produced in 360 GeV/c  $\pi^-p$  interactions  
NA27 Collaboration  
Proceedings of the 5th Moriond Workshop, p. 145
- . Charm particle decay properties  
NA27 Collaboration  
International Europhysics Conference on High Energy Physics - Bari

- . Charm meson hadroproduction in 360 GeV/c  $\pi^-p$  and 400 GeV/c pp interactions  
NA27 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Charm baryon production in 360 GeV/c  $\pi^-p$  and 400 GeV/c pp interactions  
NA27 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Inclusive production of  $\phi$ -mesons associated with other particles  
(I.V. Ajinenko ... E. De Wolf)  
XVith Symposium on Multiparticle Dynamics, Tel Aviv (1985)
- .  $K^+$  fragmentation and prompt kaon production at 70 GeV/c  
(E. De Wolf)  
XVith Symposium on Multiparticle Dynamics, Tel Aviv (1985),  
International Europhysics Conference on High Energy Physics - Bari, and Bulletin IIHE 85/02
- . Is KNO scaling dead ?  
UA5 Collaboration  
Vth Topical Workshop on  $\overline{pp}$  collider physics - St Vincent, Aosta - also CERN EP 85/82
- . First results from 900 GeV pulsed collider  
UA5 Collaboration  
XVith Symposium on Multiparticle Dynamics - Kiryat Anarim
- . On scale breaking in multiplicities and a new empirical rule  
UA5 Collaboration  
XVith Symposium on Multiparticle Dynamics - Kiryat Anarim
- . Physics at  $\sqrt{s} = 900$  GeV from the UA5 experiment at the SppS collider  
UA5 Collaboration  
Physics in Collisions V - Autum
- . A silicon microstrip beam hodoscope vertex detector  
(E. Chesi, ... R. Roosen)  
International Europhysics Conference on High Energy Physics - Bari
- . Uranium hadron calorimetry in the energy range 135-350 GeV  
WA78 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Measure of the A dependence of the hadroproduction cross section of  $D\overline{D}$  pairs  
WA78 Collaboration  
International Europhysics Conference on High Energy Physics - Bari

- . Cross sections and multiplicity distributions for  $K^+p$  and  $\pi^+p$  interactions at 250 GeV  
NA22 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Multiparticle production in  $\pi^+p$  and  $K^+p$  interactions with Al and Au nuclei at 250 GeV  
NA22 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . The event shape of 250 GeV  $K^+p$  and  $\pi^+p$  interactions  
NA22 Collaboration  
International Europhysics Conference on High Energy Physics - Bari
- . Belgian contribution to the construction of the DELPHI detector at LEP  
DELPHI Collaboration  
Annual meeting of the Belgian Physical Society - Antwerp

We thank all those who contributed to the preparation of the report.