

INTER-  
UNIVERSITY  
INSTITUTE  
FOR HIGH  
ENERGIES

ULB -VUB  
BRUSSELS

ANNUAL  
REPORT  
2007



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2007

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Directors

<http://w3.iihe.ac.be>

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### **Denis Johnson (1941 - 2007)**

On May 1<sup>st</sup> 2007 Denis Johnson passed away, after a brave fight against illness.

Denis Johnson started his research career at the end of the sixties. He obtained a Ph. D. in 1971 at the University of Kansas and joined the IIHE in 1972. In the early stage of his career he worked on several bubble chamber experiments. He studied 4.5 GeV/c  $K^-d$  and 6.5 GeV/c  $K^-p$  interactions at the ZGS accelerator of the Argonne National Laboratory and 70 GeV/c  $K^+p$  and 12 GeV/c antiproton-proton interactions in the BEBC bubble chamber of CERN. After these projects he joined the UA5 streamer chamber experiment at the CERN antiproton-proton collider in which he contributed mainly to the development of the image intensifiers and the analysis of the data. In 1986 Denis Johnson joined the H1 experiment at the DESY laboratory in Hamburg, where he contributed to the construction and operation of the Central Outer Proportional chamber and the Very Forward Proton Spectrometer.

Denis Johnson was a talented physicist with skills ranging from instrumentation development to data analysis. He was curious and thorough, enthusiastic and passionate. He was also a talented teacher. He gave several courses at the VUB and at Vesalius College. He liked to teach and had a good contact with the students.

Denis Johnson worked with us for 36 years. He was a valuable colleague.

## I. INTRODUCTION

The work presented in this report is supported by the Université Libre de Bruxelles (ULB), the Vrije Universiteit Brussel (VUB), the Fonds National de la Recherche Scientifique (FNRS), the Fonds voor Wetenschappelijk Onderzoek-Vlaanderen (FWO), the Fonds pour la Formation à la Recherche dans l'Industrie et dans l'Agriculture (FRIA), the Instituut voor de aanmoediging van Innovatie door Wetenschap en Technologie in Vlaanderen (IWT), the Belgian Federal Science Policy Office and the European Union.

The scientists whose names are listed below have contributed to the various activities of the Institute in 2007.

### U.L.B.

- V. Adler (chercheur PAI)
- S. Bechet (doctorant since October 2007)
- D. Bertrand (directeur de recherche FNRS; chargé de cours à temps partiel)
- O. Bouhali (informaticien)
- O. Charaf (doctorant IISN )
- B. Clerbaux (chercheur qualifié FNRS, chargé de cours à temps partiel)
- G. De Lentdecker (chercheur qualifié FNRS: from October 2006)
- J. Delvax (boursière FRIA)
- V. Dero (doctorant IISN since October 2007)
- S. Elgammal (doctorant IISN)
- L. Favart (chercheur qualifié FNRS, chargé de cours à temps partiel)
- G. Hammad (doctorant IISN )
- T. Hreus (boursier FRIA)
- X. Janssen (chercheur FNRS)
- M. Labare (doctorant PAI)
- T. Mahmoud (chercheur PAI)
- P. Marage (professeur ordinaire)
- J. Petrovic (chercheur PAI since September 2007)
- Y. Piersaux (collaborateur scientifique)
- B. Roland (boursier Van Buuren)
- S. Rugovac (support logistique)
- J. Sacton (professeur émérite)
- Q. Swillens (boursier FRIA : from October 2006)
- R. Toncelli (collaborateur scientifique)
- C. Vander Velde (professeur)
- P. Vanlaer (1<sup>er</sup> assistant)
- P. Vilain (maître de recherche FNRS; chargé de cours temps partiel)
- G. Wilquet (maître de recherche FNRS till November 2007; chargé de cours temps partiel)

**V.U.B.**

- A. Astvatsatourov (postdoctoraal onderzoeker FWO till November 2007)
- B. Baret (postdoctoraal onderzoeker FWO)
- P. Bruyndonckx (wetenschappelijk medewerker GOA, 10% docent)
- J. Dang (wetenschappelijk medewerker China Scholarship Council)
- C. De Clercq (hoofddocent)
- O. Devroede (wetenschappelijk medewerker)
- S. De Weirdt (wetenschappelijk medewerker FWO)
- J. D'Hondt (postdoctoraal onderzoeker FWO, docent)
- O. Depaepe ( OZR-IWT overbruggingsbeurs since October 2007)
- J. Heyninck (IWT specialisatiebeurs)
- D. Hubert (wetensch medewerker FWO till 30 September 2007, wetensch. medewerker OZR-VUB since October 2007)
- D. Johnson (wetenschappelijk medewerker, † 1st of May 2007)
- C. Lemaître (IWT specialisatiebeurs)
- J. Lemonne (gewoon hoogleraar, professor-emeritus)
- J. Maes (IWT specialisatiebeurs)
- M. Mozer (wetenschappelijk medewerker FWO)
- A. Rizzo (wetenschappelijk medewerker FWO)
- R. Roosen (onderzoeksdirecteur FWO)
- S. Tavernier (gewoon hoogleraar)
- F. Udo (wetenschappelijk medewerker)
- R. Vandenbroucke (logistiek medewerker VUB)
- W. Van Doninck (onderzoeksdirecteur FWO, on leave of absence at CERN)
- P. Van Mulders (IWT specialisatiebeurs)
- I. Vilella (wetenschappelijk medewerker FWO)
- M. Wedrowski (wetenschappelijk medewerker Bilateraal akkoord Vlaanderen-Polen )
- L. Zhi (wetenschappelijk medewerker Bilateraal akkoord Vlaanderen-China)
- E. Wieers (wetenschappelijk medewerker, XIOS Limburg)

W. Beaumont, M. Cardaci, E. Delanghe, E. Delmeire, A. De Roeck, M. Hashemi, S. Ochesanu, M. Ripert, D. Sunar, T. Sykora, P. Van Mechelen and E. De Wolf from the Universiteit Antwerpen (UA) have been working in close collaboration with the Institute.

Research in the field of telecommunications and data communication is conducted at IIHE by O. Bouhali and R. Vandenbroucke in collaboration with the members of the "Service Télématique et Communication" led by P. Van Binst at the ULB.

## II. RESEARCH ACTIVITIES IN PARTICLE AND ASTROPARTICLE PHYSICS

### II.1. NEUTRINO PHYSICS

#### A. THE CHORUS EXPERIMENT (CERN WA95)

*(P. Vilain, B. Van de Vijver, G. Wilquet)*

Built in 1993, the CHORUS detector has been exposed between 1994 and 1997 to the CERN-SPS neutrino beam. About one million interactions were recorded in the 770 kg nuclear emulsion target and more than 10 millions were produced in the calorimeter and spectrometer material. Events of this latter type were also recorded in 1998, when the beam was mainly operated for the NOMAD experiment.

The main purpose of the experiment was the search for  $\nu_\mu$ - $\nu_\tau$  oscillation through the observation for the reaction  $\nu_\tau + N \rightarrow \tau^- + \text{hadrons}$ . In a two-neutrino mixing scheme, a 90% C.L. upper limit of  $\sin^2 2\theta_{\mu\tau} < 4.4 \times 10^{-4}$  is set for large values of  $\Delta m^2$ . The paper, submitted in 2007, has been published in 2008.

Final results on  $\nu_\mu \rightarrow \nu_\tau$  oscillation from the CHORUS experiment.

A. Kayis-Topaksu et al.  
Nuclear Physics B 793 (2008) 326  
CERN-PH-P/2007-034, arXiv:0710.3361

The analysis of the unprecedented large and unbiased sample of charmed particles production and decay events is still in progress. In addition to the about 15 papers published earlier from these data, two papers have been published in 2007 and one accepted for publication:

Charge-Particle Multiplicities in Charged-Current Neutrino and Anti-Neutrino-Nucleus Interactions.

A. Kayis-Topaksu et al.  
Eur. Phys. J. C 51, 775-785 (2007)  
CERN-PH-EP/2007-023, arXiv:0707.1586

Associated Charm Production in Neutrino-Nucleus Interactions.

A. Kayis-Topaksu et al.  
Eur. Phys. J. C 52, 543-552 (2007)  
CERN-PH-EP/2007-031, arXiv:0708.2820

Leading Order Analysis of neutrino induced di-muon events in the CHORUS experiment

A. Kayis-Topaksu et al.  
Accepted for publication in Nucl. Phys. B.



## B. THE OPERA EXPERIMENT (CERN CNGS1).

(G. Van Beek, P. Vilain, G. Wilquet)

In 2000, the CERN Council approved the construction of the SPS CNGS neutrino beam, pointing towards Gran Sasso LNGS underground laboratory. The long baseline neutrino oscillation OPERA project, based on this beam, was approved in February 2001.

The motivation for this experiment resides in the now clear evidence, mainly from the Super-Kamiokande experiment, of an energy and zenithal dependent deficit in the flux of atmospheric  $\nu_\mu$ 's. The data are well fitted in terms of  $\nu_\mu$ - $\nu_\tau$  oscillation for  $\Delta m^2$  about  $2.5 \cdot 10^{-3} \text{ eV}^2$  and  $\sin^2 2\theta > 0.9$  and compatible with full mixing. OPERA aims at covering this domain of the parameters space and demonstrate the  $\nu_\mu$ - $\nu_\tau$  oscillation hypothesis through the direct observation of  $\nu_\tau$  interactions.

The detector design is based on two conflicting requirements: the  $\tau$  detection calls for the spatial resolution of nuclear emulsion but the target mass must measure in kilotons in order to accumulate the required statistics of about 30 000 interactions. The solution consists in stacking 1 mm thick lead foils interleaved with 200  $\mu\text{m}$  plastic sheets covered on both sides by 50  $\mu\text{m}$  emulsion layers. Detailed simulations of this configuration have shown that high  $\tau$  detection efficiency can be preserved while keeping the background at a tolerable level.

The modular detector structure is as follows:

- 56 foils of lead interleaved with emulsion sheets of about 120  $\text{cm}^2$  area stacked to form a 8.5 kg brick;
- 3264 bricks are assembled in a wall. Each wall, of about 40  $\text{m}^2$  area, is followed by a pair of orthogonal planes of plastic scintillator strips trackers constituting the target tracker and designed primarily to accurately predict the position of the events in the target;
- A super-module is made from 31 walls; it is followed by a muon spectrometer constituted of a dipole magnet instrumented with resistive plate chambers and equipped with high precision trackers made of drift tubes planes;
- Two identical super-modules compose the detector that reaches an effective target mass of 1800 tons.

Our group was more specifically involved in the conception, construction and installation of the target trackers together with two groups of IN2P3 (IPHC, Strasbourg and LAPP, Orsay), the universities of Bern and Neuchâtel, and JINR, Dubna. A tracker plane consists of 4 modules, each composed of 64 7-m long scintillator strips equipped with wavelength shifting fibres. A tracker is made of two planes with orthogonal readings. The optical signals transmitted by the fibres are readout at both ends by 64-channel photomultipliers. The description of the target tracker is the object of a publication:

The OPERA experiment target tracker

T. Adam et al.

Nuclear Instruments and Methods A 577 (2007) 523 and arXiv:hep-ex/0701153

The commissioning of all the electronic detectors was completed by mid-2007 using cosmic muons.

A sample of 319 neutrino interactions occurring in the electronic detectors and in the walls of the surrounding cavern have been recorded during a first period of commissioning of the CNGS beam in August 2006. Their analysis is the topic of the first publication of the OPERA Collaboration:

First events from the CNGS neutrino beam detected in the OPERA experiment

R. Acquafredda et al.

New Journal of Physics 8 (2006) 303 and arXiv:hep-ex/0611023

A three-week period of beam time foreseen in November 2006 was shortened to less than two days due to a major fault in one of the beam reflectors. Another three-week period of medium intensity beam was foreseen in October 2007 following a period of similar duration for the CNGS final commissioning. It was again interrupted after only some hours because of irreversible radioactivity damages to the ventilation control electronic situated in the vicinity of the neutrino target.

Nonetheless, a small sample of 38 neutrino interactions (29 CC and 9 NC) were reconstructed by the electronic detectors as occurring in the target bricks. Of these, 28 have been located in the emulsion sheets and the vicinity of their vertices analysed. A charm-decay candidate has been identified. Though with a very small statistics, this demonstrates the capability of the technique to predict, locate and recognize tau-like events. The analysis of 8 more events is in progress.

In the mean time, a task force set-up by CERN has identified two complementary sources for the CNGS fault: insufficient radiation shielding and use of inappropriate non-radiation hard electronic components. From the work-plan in progress, one expects stable beam conditions from the end of June 2008.

The filling of the target at high speed has started in March 2007 and is planned to be completed by mid-July 2008, more or less in time with the beam.

**C. THE ICECUBE EXPERIMENT**



Areal view of the Amundsen Scott South Pole station. On the left of the skiway one sees the station (long building) with accomodation, cafetaria etc. On the right of the skiway the IceCube construction site is visible. The distance between the station and the nearest IceCube strings is about 1km

*(B. Baret, D. Bertrand, C. De Clercq, O. Depaepe, D. Hubert, M. Labare, J. Petrovic, A. Rizzo and Q. Swillens)*

This research project is pursued in collaboration with J.-M. Frère (“Professeur Ordinaire” in theoretical physics at the ULB), co-promotor at the FNRS level.

The AMANDA neutrino telescope is designed for the observation of high energy neutrinos from astrophysical sources in the northern hemisphere. The detector is located at the geographical South Pole and consists of 677 photo multiplier tubes (PMT) of a diameter of 8 inches deployed on a cylindrical array of a diameter of 200m and a height of 500m in the Antarctic ice at a depth of 1500m. A telescope of a second generation, IceCube, is presently under construction. A volume of 1 km<sup>3</sup> will be equipped with a total of 4800 PMT’s of a diameter of 10 inches at depths between 1500 and 2300m completed by 160 surface stations made of 2m<sup>3</sup> ice tanks containing 2 PMT’s each. The PMT’s measure the Cherenkov light emitted in the ice by charged relativistic particles, like the muons produced in charged current muon-neutrino interactions below the detector or the light resulting from cascades produced by electron or tau-neutrinos in the detector.

Since the beginning of 2008, 2560 IceCube PMT’s are deployed on 40 strings in the ice and 80 tanks are installed on the surface. This represents 50% of the Icecube telescope. As the drilling procedure has reached a high level of performance and reliability (18 holes were drilled during this year campaign) it is planned to complete the IceCube detector by 6 high density DOM’s strings at high depth. This so-called

IceCube Deep Core is intended to replace AMANDA after 2010. It will be deployed in a very pure ice region identified by the data collected by the IceCube strings already deployed. The IceCube detector will be used as a veto surrounding the Deep Core detector allowing observations towards the Galactic center. The short spacing of the DOM's will allow a lower energy threshold for the detector ( $\sim 10$  GeV) as well as better energy and angular resolutions. These performances will benefit to the indirect WIMP searches, the neutrino oscillation studies and to the point-like neutrino sources searches in the southern hemisphere.

Calibrations are performed on the modules presently deployed, and the physics analysis has started on a combination of data sampled from the AMANDA. In these analyses optimal use is made of the complementarity of AMANDA and IceCube. AMANDA with its denser instrumentation is more sensitive to low energy neutrinos, while IceCube with its larger surface has a better sensitivity for high energy neutrinos. In the context of the preparation of the IceCube detector, the OM tests which were started at the IIHE in 2001 were pursued. Two IceCube DOMs were used to perform various sensitivity tests to led light. The TestDAQ software was run on a DomHub in order to develop a slow control monitoring program. A first version of this software is presently running and has been tested on the large test station of the PSL laboratory in Madison (Wisconsin).

The main results published in 2007 by the IceCube collaboration are:

- **Five years of searches for point sources of astrophysical neutrinos with AMANDA-II neutrino telescope.**

A sample of 4282 events consisting of upward going muon tracks with high reconstruction quality and energy larger than about 100 GeV was analysed. No indication of point sources neutrinos was found and 90% confidence level flux upper limits for an all-sky search as well as for a catalog of 32 selected sources were set. For the first time the contribution of tau neutrinos was taken into account. A stacking analysis for preselected active nuclei and a search based on the angular separation of events were also performed. These limits are the most stringent established to date, including the results of a detailed assessment of systematic uncertainties.

- **Detection of atmospheric muon neutrinos with the IceCube 9-string detector.**

In 2006, 9 strings of the IceCube detector were operational. Within the data acquired from the detector in this configuration, an atmospheric neutrino signal, consistent with expectations was observed. This demonstrated that the IceCube detector concept was working and helped in the calibration of the deployed strings.

- **Multiyear search for a diffuse flux of muon neutrinos with AMANDA-II.**

A search for TeV-PeV muon neutrinos from unresolved sources was performed on AMANDA-II data collected between 2000 and 2003 with an equivalent live time of 807 days. This diffuse analysis sought to find an extraterrestrial neutrino flux from sources with non thermal components. The signal is expected to have harder spectrum than the atmospheric muon and neutrino backgrounds. No excess of events was seen in the data over the expected background. The most sensitive diffuse astrophysical limit to date was set assuming a  $E^{-2}$  energy flux dependence.

- **Search for neutrino-induced cascades from gamma-ray bursts with AMANDA.**

Two analyses searching for neutrino-induced cascades from gamma-ray bursts were performed. No evidence of astrophysical neutrinos was found, and limits for several models were set. Neutrino effective areas were also determined in order to allow the calculation of limits for any neutrino production model. The first analysis looked for a statistical excess of events within a sliding window of 1 or 100s (for short and long burst classes, respectively) during the years 2001-2003. For this search, 90% of the neutrinos would fall in the energy range 50TeV to 7PeV. The second analysis looked for neutrino-induced cascades in coincidence with 73 bursts detected by BATSE in the year 2000. These analyses lead to limits in the range of two orders of magnitudes above the theoretical predictions. However the neutrino-induced cascade channel is complementary to the up-going muon channel and this study is a good preparation for the future use of IceCube detector which will have a much higher sensitivity.

## Activities of the IIHE group

Our group took a large responsibility in the analysis of the data taken with AMANDA-B10 in 1997-99. This is a difficult task as the reconstruction and simulation programs had to be adapted to the varying detector configuration (10 strings in 98, 13 strings in 99). On another side, new analyses were initiated on the combination of AMANDA and IceCube data.

The data taken with AMANDA II in 2001-03 are being analyzed with the aim of searching for WIMP annihilations in the Sun. The main effort was put on the selection procedure, the data quality verification and on the simulations. The trigger conditions to accept data were also extended to include low threshold string triggered events with a large gain in statistics for WIMP masses below 200 GeV. The results from this analysis will be published at the end of this year. Since IceCube is now larger than AMANDA it was decided to combine the full 2001-06 dataset in a search for neutralinos from the Sun. This analysis started in 2006 and is performed by our groups. In 2007, a new analysis based on a search for Kaluza-Klein dark matter in the Sun was started. The combined data from the present IceCube detector and from AMANDA will be used.

We developed a new strategy of point source search based on the False Discovery Rate method which was already used in other astrophysical studies (WMAP analysis, search for galaxy clusters, ...). As the method is only based on the background distribution, limits can be derived without any assumption on acceleration mechanisms inside the sources. Moreover, the robustness of the method, could lead to a gain in sensitivity of the analysis.

Finally, a new analysis was started at the end of 2007, aiming to the identification of tau neutrino tau interactions inside IceCube. This kind of events are less sensitive to the background and could lead to a better estimation of the very high energy ( $> 10^{17}$  eV) flux of cosmic neutrinos.

## II.2. STUDY OF $E^+ E^-$ ANNIHILATION AT LEP – THE DELPHI EXPERIMENT

*(D. Bertrand, C. De Clercq, J. D'Hondt, J. Lemonne and J. Wickens)*

During 12 years, between 1989 and 2000, the DELPHI experiment has taken about 4million events at the  $Z^0$  resonance (LEP I experiment), and about 10,000 W-pair events at energies between 161 and 209 GeV (LEP II experiment).

The analysis of the data is nearly finished. In the following, the main results published in 2007 are discussed and the recent contributions from the physicists of the Brussels group are outlined.

### 1. Results published in 2007. The Brussels group played a major role in the study of color reconnection effects.

- Study of multi-muon bundles originating from cosmic ray air showers.  
The fine granularity of the hadron calorimeter was used to measure muon multiplicities in events of cosmic origin. The cosmic triggers were taken in 1999-2000 in 'parasitic' mode, in between normal triggers. A comparison of the muon multiplicities with the predictions of the CORSIKA/QGSJET01 model revealed that this model is not adequate to describe cosmic ray air showers at depths around 100m.
- Search for pentaquarks.  
A search was made for pentaquarks in the hadronic Z final states. The separation of signal and background relied on the powerful particle identification of the DELPHI detector. A search was made for the following states:  $\Theta^+(1540)$ ,  $\Phi^-(1860)$ ,  $\Theta_c^0(3100)$ . None of the states searched for were found, and 95% C.L. upper limits were set on the average production rates of such particles per Z hadronic decay, e.g.:  

$$\langle N_{\Theta^+} \rangle \times \text{BR}(\Theta^+ \rightarrow pK_s^0) < 5.1 \times 10^{-4}$$
 These limits improve previously published results.
- Investigation of color reconnection in WW events  
Color reconnection was studied in fully hadronic WW final states. Two complementary analyses were performed, one studying particle flow between jets, and the other studying the effect on the W-mass estimators. The Brussels group played a key role in the latter analysis. The results were combined and compared to models. In the framework of the SK-I model the  $\kappa$  parameter most compatible with the data was found to be  

$$\kappa_{\text{SK-I}} = 2.2^{+2.5}_{-1.3}$$
 corresponding to a reconnection probability in the range  $0.31 < P_{\text{reco}} < 0.68$  at 68% C.L., with its best value at 0.52.
- Z gamma\* production  
The Z gamma\* cross section was measured in several hadronic and leptonic four-fermion final states. The measurements were compared to the predictions of the Standard Model and found compatible within the errors.
- Study of neutral triple-gauge-boson couplings  
The triple-gauge-boson couplings ZZZ, ZZ gamma and Z gamma gamma were studied using different four-fermion final states at LEP II. No evidence for the existence of such couplings was observed, in agreement with the Standard Model.
- Search for a fourth generation b' quark  
A search was performed at LEP II for pair production of fourth generation b' quarks. No evidence for a signal was found. Upper limits on  $\text{BR}(b' \rightarrow bZ)$  and  $\text{BR}(b' \rightarrow cW)$  were obtained for b' masses ranging from 96 to 103 GeV/c<sup>2</sup>. These limits, together with the theoretical branching ratios predicted by a sequential fourth generation model were used to set a limit on the elements of the extended CKM matrix.

### 2. Study of the W-boson polarization and charged triple-gauge-boson couplings. The Brussels group played a major role in the study of the W-boson polarization and the estimation of charged triple-gauge-boson couplings (TGCs) in semi-leptonic WW final states. The analysis was

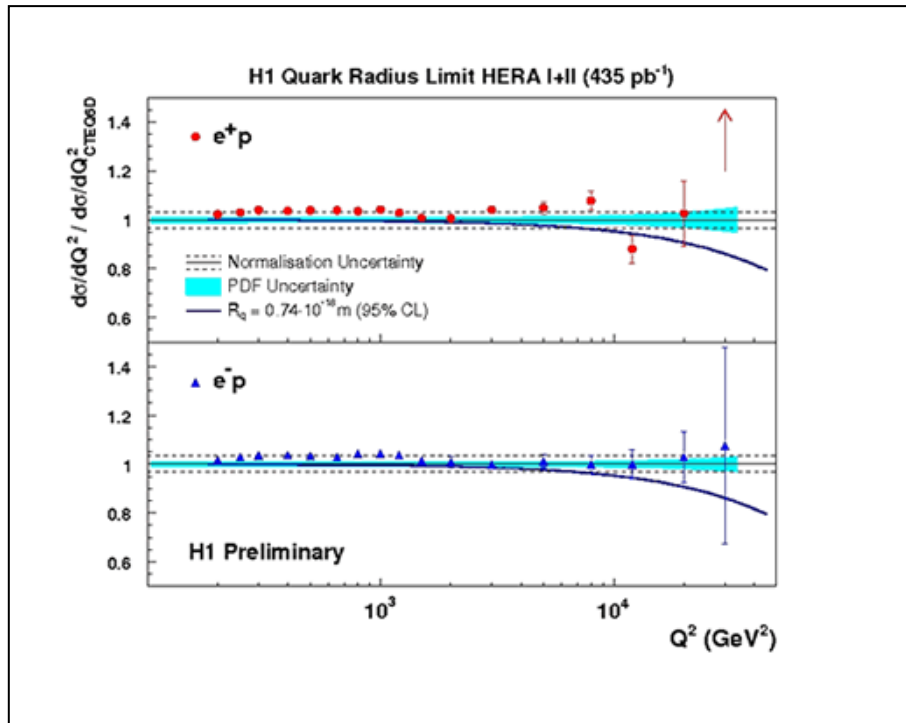
finalised in 2007 and the results have been published in the beginning of 2008. The mean fraction of longitudinally polarized W-bosons at LEP II was found to be  
 $\sigma_L/\sigma_T = 24.9 \pm 4.5 \text{ (stat)} \pm 2.2 \text{ (syst)} \%$

The CP-violating couplings were determined to be

$$g_4^Z = -0.39_{-0.20}^{+0.19}$$
$$\tilde{\kappa}_Z = -0.09_{-0.05}^{+0.08}$$
$$\tilde{\lambda} = -0.08 \pm 0.07$$

in agreement with the predictions of the Standard Model.

### II.3. STUDY OF EP COLLISIONS AT HERA – THE H1 EXPERIMENT



Comparison of the Standard Model predictions to the measured  $e^+p$  cross sections for  $Q^2 > 200 \text{ GeV}^2$  assuming a hypothetical finite quark radius  $R_q$ , shows that  $R_q < 0.74 \cdot 10^{-18} \text{ m}$  with a 95% CL exclusion limit. To be compared with electron radius limit which electron radius limit which is  $R_e < 0.28 \cdot 10^{-18} \text{ m}$ .

*(A. Astvatsatourov, J. Delvax, E. De Wolf, L. Favart, T.Hreus, X. Janssen, P. Marage, B. Roland, R. Roosen, D.Sunnar, T.Sykora, and P. Van Mechelen)*

The HERA accelerator continued high luminosity  $e^+p$  running during the beginning of 2007, collecting 53 pb<sup>-1</sup>. After this, HERA switched to low energy running. From beginning of April until end of May the proton energy was lowered to 460 GeV and a total luminosity of 14 pb<sup>-1</sup> was accumulated. During the month of June a luminosity of 7.3 pb<sup>-1</sup> was collected with the proton energy set to 575 GeV. The low energy runs were a high priority request for the determination of the longitudinal proton structure function. The low energy running also signaled the end of the HERA accelerator as it was shutdown on June 30<sup>th</sup>.

During 2007 the VFPS detectors, which are under the responsibility of the Belgian groups (IIHE-UA), were continuously taking data in standard mode, keeping the established proton beam parameters as established during the 2006 running. The VFPS collected more than 80% of the data simultaneously recorded by H1 which means a very good performance taken into account the moving in/out sequences of the Roman pots. In total the VFPS collected about 150 pb<sup>-1</sup> in the high luminosity running mode. In the low energy mode the VFPS was also operational, but its acceptance in this mode is reduced by a factor of 2.

The main activities of the group, related to the VFPS project, can be divided in 2 topics:

- The study of the various proton beam parameters applied during the 2006 running period and their influence on the momentum measurement of the diffracted proton. Reproducing VFPS measurements by Monte Carlo using the proton beam spectrometer information is basic to any



momentum reconstructed and is yet not fully understood. The multiple beam parameter setting used in 2006 don't ease the problem.

- Two analysis using the VFPS data are presently ongoing. The first analysis, which is in a very advanced state is measuring the F2D3 structure function. The second analysis concerns di-jet events in deep inelastic scattering and in photo-production with the purpose to shed further light on the factorisation breaking observed in photoproduction by measuring the 4-momentum transfer using the VFPS. These analyses were presented at the DIS2007 workshop.

During 2007, H1 published a total of 9 articles in international journals. The most important results are:

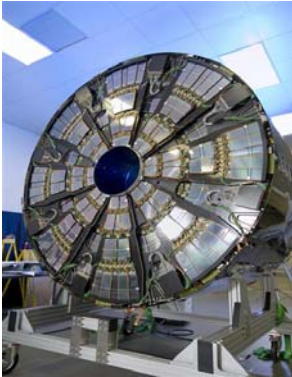
- **QCD and jets**  
 Inclusive single end double differential jet measurements have shown to be well described by NLO QCD. From the ratio of the inclusive jet to neutral current cross section a value of  $\alpha_s(M_Z) = 0.1193 \pm 0.0014(\text{exp}) + 0.0047 - 0.0030^{(\text{th})} \pm 0.0016(\text{pdf})$  was deduced. Different corners of phase space were further investigated using 3- and 4-jet production at low-x. A good overall description is obtained by using fixed order  $O(\alpha_s^3)$  calculations.  
 Study of diffractive dijet events have led to constrain the diffractive parton densities in phase space regions where the inclusive diffractive measurements were not very sensitive. In particular this has led to an improved precision gluon density.  
 Comparison of the diffractive dijet production in deep inelastic scattering and photoproduction has shown that QCD factorisation is broken by a factor as large as  $(50 \pm 10)\%$ . This phenomenon will be further investigated by the ongoing VPFS analysis.  
 Large improvement in the statistics of deeply virtual Compton scattering process has led to a differential study and a determination of the t-dependence of the cross section,  $b = 5.45 \pm 0.19 \pm 0.34 \text{ GeV}^{-2}$ . The importance of the DVCS process stems from the fact that it gives further insight into the generalised parton densities (GPD). The present data exhibit the properties predicted by the GPD models.
- Inclusive isolated photon cross sections in deep inelastic scattering have been measured with and without an additional jet. Predictions based on LO ( $\alpha^3 \alpha_s^0$ ) and NLO ( $\alpha^3 \alpha_s^1$ ) are shown to underestimate the measurements by about a factor of 2. Further theoretical investigations are needed to understand the discrepancy.
- A search for lepton flavor violation in  $ep \rightarrow \mu, \tau + X$  processes has shown no evidence for any signal which leads to exclusion of  $\mu(\tau)$ -q pair masses of  $459(379) \text{ GeV}$  with 95% confidence level.

## ACTIVITIES OF THE IIHE AND UA GROUPS

The physicists of the IIHE and UA have been working in the field of diffraction:

- VFPS data analysis and momentum determination of the diffractive proton (4 postdoc - UA - VUB)
- Analysis of inclusive diffractive events using the VFPS (1 postdoc, 1 PhD - ULB)
- Analysis of diffractive events with 2 jets using the VFPS (1 PhD - ULB).
- Deeply Virtual Compton Scattering (1 PhD - ULB)
- Vector Meson production rho and phi (1 postdoc - ULB).
- Hadronic Final State (PhD- UIA).

## II.4. STUDY OF PP COLLISIONS AT LHC – THE CMS EXPERIMENT



*(V. Adler, O. Bouhali, O. Charaf, B. Clerbaux, G. De Lentdecker, V. Dero, O. Devroede, S. De Weirdt, J.P. Dewulf, J. D'Hondt, Sh. Elgammal, R. Goorens, G. Hammad, J. Heyninck, J. Maes, M. Mozer, P. Marage, S. Tavernier, C. Vander Velde, W. Van Doninck, P. Vanlaer, L. Van Lancker, P. Van Mulders, I. Villela, J. Wickens).*

During the year 2007, the Large Hadron Collider (LHC) entered its final construction phase. This machine, which will allow to study proton-proton interactions at a centre-of-mass energy of 14 TeV with luminosities around  $10^{34} \text{cm}^{-2} \text{s}^{-1}$ , is expected to start during the summer 2008. Two multipurpose detectors, ATLAS and CMS, are presently being installed at the LHC.

A large research program will be performed at this collider. The machine and detectors have been optimized for the search for new physics at high energy, with particular focus on the discovery of the Higgs boson(s) over a very large mass range. It will discriminate between different theories to extend the Standard Model, with, for example, the observation of supersymmetric particles or with manifestation of extra spatial dimensions. Studies of the top quark properties will become possible due to the large top pair production rate.

The Compact Muon Solenoid (CMS) collaboration consists of more than 2000 physicists and engineers from 176 institutes all over the world among which six Belgian research groups from the IIHE (ULB- VUB), UA, UCL UGent and UMH. Gent joined the collaboration only recently and will participate to the construction of still missing RPC muon chambers. The five other Belgian teams have chosen already in 2000, to participate to the design and construction of the Silicon tracker detector of CMS. The IIHE took the following responsibilities that were completed in 2006: coordination of the design and production of 17000 pitch adapters and frame supports for the Silicon detector modules, assembly of 7000 of the frames, assembly of around 1800 detector modules, mounting of modules on 32 support structures in the shape of a sector of a wheel (so called petals), and detailed long term tests of these petals.

In 2007, physicists from the IIHE participated to shifts during data taking with cosmic rays, at CERN. For these tests, 20% of the full tracker was used, allowing testing the full data taking and online monitoring chain. The tracker data obtained were of very high quality, demonstrating that it fully satisfies the specifications. In December, the full tracker was lowered to the experimental area, 100 m underground and inserted successfully into CMS.

In parallel, the CMS physicists of the IIHE continue to prepare the physics analyses. They contribute to the simulation studies of several physics channels of high relevance at the LHC. They participate to the development of the simulation and reconstruction programs which are required in order to perform the analyses. The two main physics topics are the search for high mass resonances decaying into electron or photon pairs and the study of the semi-leptonic decay of top-antitop quark pairs.

**SEARCH FOR HIGH MASS RESONANCES:**

High mass resonances decaying into electron or photon pairs provide some of the most important discovery potentials beyond the Standard Model at the LHC. They are predicted in various models (gravitons and gauge bosons in extra dimension models, new Z bosons in supersymmetric and GUT models, etc.). The search for pairs of electrons and photons with high transverse momentum is thus one of the hottest topics for CMS from the very beginning of the data taking at 14 TeV.

Since a couple of years physicists of the IIHE play a leading role in the preparation of the physics analyses for the search of heavy resonances decaying into electron pairs. They initiated the creation of the HEEPP (High Energy Electron and Photon Pairs) working group composed of about ten European and American institutes meeting regularly under the co-chairmanship of B. Clerbaux..

In 2007 the strategy to adopt with first data to allow a fast discovery of high mass resonances was further refined as the studies of the detector response to high electromagnetic objects, typically of transverse momentum larger than 100 GeV/c. The main contributions of the IIHE physicists concern the modification, implementation and study of the trigger system for efficient high energy electron pairs online selection, the improvement of the measurement of very high energy electrons by correcting for detector dead spaces and electronics saturation, the determination of their identification and reconstruction efficiencies namely from data, the backgrounds estimation from data and the study of general characteristics of Drell-Yan events.

Finally, since December 2006 and for two years, Pascal Vanlaer, member of the HEEPP group and expert in vertex reconstruction, is co-coordinator of the group in charge of the reconstruction of the electrons and photons for the whole CMS collaboration. In this framework, he developed methods to validate the quality of electron tracks reconstruction from data rather than from simulation and robust algorithms to distinguish electrons from jets; he worked on the standardization of electron reconstruction techniques; he contributed to the improvement of the validation procedure of simulated data and organized their distribution between the various groups.

**STUDY OF TOP QUARK PAIRS:**

The top quark is the heaviest particle within the Standard Model of particle physics. Due to its high mass it was only discovered in 1995 at the proton/anti-proton Tevatron collider (Chicago, U.S.). In the exploitation phase of the Large Hadron Collider millions of top quarks will be produced each year. These data will open a new window to precision measurements of the properties of the top quark and their production mechanisms. With these measurements, the Standard Model will be tested at its frontier. Moreover, any deviation from the Standard Model predictions might reveal new physics, beyond the Standard Model.

The physicists from the IIHE aim to contribute to a precise determination of the top quark mass from semi-leptonic decaying top quark pair events, with a total uncertainty of  $\sim 1 \text{ GeV}/c^2$  or better. This potential measurement would be the most precise measurement of this Standard Model parameter. They also plan to measure the top quark pair production cross-section and to study spin correlations through the study of angular distributions. New physics will be searched for by studying some topological and kinematical characteristics of the events. The first variable to be investigated will be the top-antitop invariant mass as the shape of its distribution is expected to be very little affected by the presence of remaining QCD background. The existence of a new massive particle like an additional gauge boson  $Z'$  would show up as a peak in such distribution. In the case of the two doublets Higgs model, the existence of a scalar Higgs boson might be revealed by a more general distortion of the invariant mass distribution.

But before tackling these exciting physics issues with the first data expected late in 2008, the reconstruction procedures, the event selection and the statistics analysis tools need to be built and tested. During 2007, the IIHE top physics group initiated the development of a dedicated software package within the standard CMS software, to optimize and standardize the technical aspects of the top physics analysis, the Top Quark Analysis Framework (TQAF). The main contributions of the IIHE physicists concern signal selection by mean of a likelihood ratio method, kinematical fitting, fake jet rejection, b-

quark identification and a tool for fast study of some systematic effects. The TQAF now became a prototype for a more general analysis software tool for the whole CMS collaboration, the Physics Analysis Tool (PAT), to be developed in 2008.

The year 2007 was also used to further investigate some crucial steps of future analyses. The strategy for the estimation of the jet energy scale corrections was refined. These corrections are based on Monte Carlo simulations tuned first on beam test data and later, when available, on collider data. They take into account offset corrections for pile-up, noise, and effects of thresholds, dependence of the calorimeter response to the jet pseudorapidity and transverse momentum, jet flavor and contribution of the underlying events. The method to estimate the efficiencies for tagging the b-quark, and c-quark jets from data has been further worked out. Event samples identified as semi-leptonic and fully-leptonic decays of the top-antitop pairs are used. Different techniques based on extraction of high purity b-flavored jets, or on requiring the consistency between the observed and expected numbers of tags in the events will be used to study the heavy flavor algorithms. These techniques can also be extended to measure the mis-tag rates for light quark jets in the future. The simulation of more QCD events showed that the foreseen cuts are not sufficient to reject this background; better cuts are being designed. A precise estimation of the QCD contribution is needed as the cross-section of this channel is huge compared to this of the top signal. As the QCD cross-section normalization is poorly predicted, a method to normalize it with data is being studied.

Finally, since December 2006 and for two years, Jorgen D'Hondt, is co-coordinator of the group in charge of the physics analyses on the top quarks for the whole CMS collaboration.

#### **GRID DEVELOPMENTS:**

The CMS team also contributes significantly to the deployment of the LHC Computing Grid (LCG). Belgium offers a Tier2 centre installed partly at the IIHE, partly at UCL. In 2007 the Belgian Tier2 participated significantly to the production of simulated data for the CMS collaboration, 6,5 millions of events for the IIHE only. In addition, one of the six teams of simulated data production of the CMS collaboration, the LCG-5 team, was made of IIHE physicists and computer scientists. The IIHE team handled 20% of the total Monte Carlo production over 2006 and 2007. This production was distributed over the Tier2 centres of Belgium, France and Germany.

During summer 2007, 10 SuperMicro TwinServer machines (20 quad-core processors) and 20 TB of data storage were installed at the IIHE. The new versions of software components were installed regularly on the Belgian Tier2 machines, in particular the "scientific linux CERN version 4" operating system that is now needed to run the CMS software.

Following the first major computing challenge of last year called "Computing, Software and Analysis Challenge 2006" (CSA06), the next challenge, CSA07, was performed in 2007 and the IIHE participated actively to its success. This time, twice as much resources as in 2006 had to be involved, namely 50% of those needed during LHC data taking. The technical team worked to insure reliable data transfers between the Belgian Tier2 and the 7 CMS Tier1 distributed in different places in Europe and in the States. These transfers occurred successfully with a bandwidth of 50 MB/s. Physicists were also involved in this exercise.

### III. APPLIED R&D AND SPIN-OFF

#### III.1. DATA ACQUISITION R&D PROJECT

*(D. Bertrand, G. De Lentdecker, J-P. Dewulf, X. Janssen, P. Marage, C. Vander Velde)*

In 2007, the IIHE started a program of research and development in the field of data acquisition systems for the next generation of high energy physics experiments. One of such experiment could be an electron-positron linear collider, where detectors are envisioned to be precision instruments that can measure Standard Model physics processes at the electroweak scale and discover new physics processes beyond it.

Currently two out of three experiment designs of the future International Linear Collider (ILC) plan to use a Time Projection Chamber (TPC) as the tracking device to provide high track reconstruction efficiency with a momentum resolution of the order of  $\Delta p/p^2 = 5 \cdot 10^{-5} \text{ (GeV/c)}^{-1}$ . One option for the TPC end-plate is to use a Gas Electron Multiplier (GEM) or a MICROMEGAS as the gas amplification structure, coupled with small read-out pads.

In order to study the performance of such TPC a large prototype is being built, offering some modularity with respect to the gas amplification technology, the pad size and geometry as well as the read-out system.

In this framework, the main read-out system which has been developed is based on the read-out electronics used in the ALICE experiment. However some modifications have been necessary in order to adapt it to the expected output signals, including a new programmable charge pre-amplifier.

The Data Acquisition (DAQ) system of the TPC prototype is developed by the IIHE in collaboration with the University of Lund and CERN. In this project, the IIHE is responsible, among others, of the programming of the Board Controller FPGA located on the Front-End Card (FEC) to set the new pre-amplifier parameters (gain, decay time, etc.). The IIHE is also responsible for the design of a synchronization board which should send the trigger signals, the time stamp and event number to the different FECs.

The large TPC prototype will be tested with this DAQ system with beams at Desy (Hamburg, Germany) at the end of 2008.

### III.2 DEVELOPMENT OF NEW SCINTILLATION MATERIALS AND OF RADIATION DETECTORS FOR BIOMEDICAL IMAGING APPLICATIONS – THE CRYSTAL CLEAR PROJECT.

*(P. Bruyndonckx, Dang Jun, O. Devroede, C. Lemaître, Li Zhi, S. Tavernier, M. Wedrowski, Els Wieers, Nuno Pereira)*

At the front line of organic research, molecular and cellular biologists engineer new molecular arrangements, including genes and proteins. Having produced these new strains, the next task is to investigate what happens when they are implanted in living tissue. The researchers want to know how the new genes "express" themselves. In a different area - pharmaceutical research - the effects of potential new drugs have to be established as quickly as possible. In the past, results have been established "in vitro", by either killing the samples or by taking biopsies. Until recently, there has been no other way of studying the effects of genetic manipulation or drug administration. Now researchers have found how imaging techniques used in medical diagnosis can be adapted for genetic or drug research, providing an immediate picture of how the modified tissue behaves "in vivo". One of these techniques is Positron Emission Tomography (PET).

Since a few years there has also been a steadily growing interest to use PET for mammography studies. Existing clinical PET systems are not optimized for this and the development of dedicated Positron Emission Mammography (PEM) scanners, which are specifically designed and optimized for the task at hand, is required.

From its inception, PET technology has continually benefited from new developments in radiation detection, first using sodium iodide crystals, then the improved performance from bismuth germinate (BGO), and more recently superior materials such as lutetium orthosilicate or aluminates, faster and more effective than BGO. The arrival of more advanced position sensitive PMTs (PS-PMTs), Avalanche photo diodes (APDs) or Silicon PMTs make it possible to read out matrices of small crystals individually without the introduction of excessive dead space.

In the framework of the Crystal Clear Collaboration (CCC), the medical instrumentation group of the IIHE, together with the UGent, CERN, the Université Claude Bernard (Lyon) and the Forschungszentrum Juelich has developed a new generation of high-resolution small animal PET scanners: ClearPET. The design of these small animal PET scanners is based on the use of position sensitive PMTs (PSPMT) and a phoswich of LSO/LuAP scintillators to provide the depth of interaction information. The IIHE research group was responsible for the design and construction of the front-end detector modules for a number of small animal PET systems developed within the collaboration. These detector modules consist of a double layered 8x8 crystal matrix mounted on a position sensitive PMT. The upper layer contains 64 LSO crystals measuring 2x2x8 mm while the bottom layer consists of 64 LuYAP crystals measuring 2x2x8 mm. A first system was installed at Ugent two years ago.

To check the sensitivity performance of the system along the scanner axis, a detailed Monte Carlo simulation was developed using GATE (Geant4 Application for Tomographic Emission). In addition to all the physical phenomena occurring in the detection processing, the data acquisition electronics has been modelled also to include effects such as dead time, event buffering, energy blurring and thresholding, data transfer rates.

A second ClearPET system is now under construction. This system will have a larger number of detector modules and longer scintillation crystals to enhance the overall sensitivity. In addition a number of mechanical changes have been made to improve the stability of the scanner and enhance the mounting accuracy of the detector modules.

In preparation for the design and construction of a new generation BrainPET scanner, studies using Avalanche Photo diodes (APD) are performed. APDs are more compact, are more easily subdivided in small pixels, and are potentially lower in cost. In these prototype detector modules, very small individual crystals are replaced by a solid scintillator block to eliminate dead zones in-between the crystals. In addition, these scintillator blocks are much cheaper to produce and easier to mount. The position and depth of interaction is determined from the light distribution measured over the pixels in the APD array. The information is extracted from the light profile using neural networks, support vector machines or statistically based methods. The performance of these detector configurations for

tomographic imaging can be evaluated on a hardware simulator. This device consists of two rotating platforms onto which two detector modules can be mounted. The two platforms can rotate over 360° and can also rotate relative to one another. This allows us to simulate a complete (or partial) detector ring and reconstruct tomographic images of an object. The resulting image showed the very encouraging resolution of 1.6 mm FWHM.

The statistical learning algorithms used to find the photon incidence position need to be trained before they can be used. An in-situ position calibration procedure has been developed which allows a fully automatic collection of a training data sets for all detector modules in a fully assembled PET system.

The BrainPET project is a joined effort of de VUB team in collaboration with CIEMAT (Madrid, Spain) and Forschungszentrum Julich (FZJ, Germany). The basic detector module will consist of a dual layer of trapezoidal LSO blocks. The complete system is comprised of 4 detector rings, each with 52 detector modules. To determine the optimal design parameters of the detector modules, GATE based Monte Carlo simulations were used. From this analysis we studied the impact of many parameters such as the crystal thicknesses, training data pattern to be recorded, electronic noise level and digitization accuracy, APD gain, position of the APDs on the LSO blocks, scattering in photo detectors and electronics very close to the scintillators. From this analysis, a decision on the final detector module design will be made in April 2008.

From the simulation studies for the BrainPET, we found that the achievable spatial resolution is mainly limited by the signal-to-noise ratio (SNR) of the APD signals. The SNR suffers from the low APD gain and high excess noise factor. The appearance of silicon PMTs on the market can remove this performance barrier. First simulation studies showed indeed an improve resolution in comparison to the use of APD.

Our research group is also involved in the development of a second generation of the ClearPEM prototypes. These are dedicated PET scanners for mammographic breast imaging. In this second generation, an ultra-sound (US) probe will be added to complement to mammographic PET studies with anatomical information. Our contribution will be the study of algorithms to fuse the PET and US images, overlaying the anatomical features with the corresponding molecular signatures of the cancer process. In order to develop and test appropriate algorithm, a suitable phantom has to be developed that can be images in both PET and US. In collaboration with the Laboratoire de mécanique et d'acoustique of the CNRS in Marseille, several material mixtures have been tested for their ultra-sonic properties (speed of sound, attenuation of sound waves, absence of shear waves,..) and compared with those found in real human breast tissue. This will now be further developed in a jelly-based, breast-shaped phantom, including small spheres representing tumors, that can be injected with radio tracers.

## IV. COMPUTING AND NETWORKING

(D. Bertrand, O. Bouhali, S. De Weirdt, G. Rousseau, S. Rugovac, S. Tavernier, E. Torisaen, P. Vanlaer, R. Vandenbroucke, D. Vijverman)

The management of the IIHE computing team is under the responsibility of O. Bouhali. This covers the following tasks:

- Coordinating the work of the computing team;
- Follow-up of the maintenance and insurance contacts;
- Planning for hardware and software upgrade;
- Providing support for Linux users;
- Co-representing the IIHE in grid related projects;
- Organizing regular meetings with the users.

### A. LOCAL CLUSTERS

The local computing facility consists of:

- A condor based cluster composed of 50 CPU's. This gives a total processing power of more than 40 GFLOPS and a 54 GB total RAM. It is used by the AMANDA/ICE<sup>3</sup> and PET members for their analysis.
- The local storage facility is composed of:
  - A SAN of type MA8000 with a raw capacity of 3 TB (RAID5);
  - A SAN of type MSA1500 with a raw capacity of 7.2 TB (RAID5);

### B. GRID COMPUTING

Grid computing is the ultimate solution for the storage and the analysis of the enormous data that is (will be) produced by the different experiments. The IIHE computing groups is involved in several national and international grid projects.

#### BEGRID

The IIHE is participating to the BEgrid initiative since its beginning in 2003.

The BEGRID platform is composed of 443 CPUs and 3.5 TB of disk space, distributed over the participating institutes.

#### CMS TIER-2

The IIHE is deploying a large computing cluster (GRID Tier2) to participate to the CMS experiment at the Large Hadron Collider (LHC) of CERN. This cluster constitutes 2/3 of the Belgian cluster dedicated to the CMS experiment, the remaining 1/3 being located in Louvain-la-Neuve. The resources located at the ULB-VUB are put in common by the experimental High-Energy Physics (HEP) groups of ULB, UMH, VUB and UAntwerpen.

The IIHE cluster is in construction at the ULB-VUB computer center (CC). A detailed report has been written to explain this choice. The main reasons are:

- Even if the main purpose of the platform is to provide computing power to the Belgian HEP community, it will be open to a level of at least 10% to the users of the Universities;
- The infrastructure (cooling, power) is, by definition, more adapted in a building designed to house computers. In addition, the vicinity of the CC to the BELNET high bandwidth Point of Presence is of crucial importance.
- It is the mission of the CC to provide help to the users of the Universities in their computing efforts.



***C. OTHER SERVICES***

We are also involved in several other grid related activities:

- Theses: one undergraduate thesis has been successfully accomplished in 2007 thanks to the collaboration between our department and the service of Computer Networking and Engineering of the Faculty of Applied Sciences (ULB).
- We are collaborating with several institutions in Morocco in terms of grid computing. The Moroccan platform is part of the EumedGrid platform.

## V. THE INTER-UNIVERSITY ATTRACTION POLE (IAP) IN FUNDAMENTAL INTERACTIONS

The IIHE (ULB-VUB) was part of the IAP 5/27 'Fundamental Interactions: at the boundary of theory, phenomenology and experiment. The IAP is now funded for another period (P6/11) and has been extended ([www.f-i.be](http://www.f-i.be)). The members of the network are: Theoretische Fysica (KUL), Elementaire Deeltjes Fysica (UA), Unité de Physique Théorique et de Physique Mathématique and Unité de Physique des Hautes Energies (UCL), Physique des Particules Élémentaires, Physique Mathématique des Interactions Fondamentales and Physique Théorique (ULB), Elementaire Deeltjesfysica and Theoretische Natuurkunde (VUB), Experimentele Deeltjesfysica (UGent), Physique Théorique Fondamentale (ULg).

The purpose of this IAP, extending over the years 2002 to 2011, is to improve our understanding of Fundamental Interactions through a closer collaboration between Belgian research teams engaged in theoretical or experimental investigations in the field.

## VI. TECHNICAL AND ADMINISTRATIVE WORK

The members of the workshop staff in 2007 were: J. De Bruyne, P. de Harenne, J.-P. Dewulf, L. Etienne, R. Goorens, S. Hannaert, G. Van Beek, R. Vanderhaeghen, L. Van Lancker and Ch. Wastiels, with the help of A. De Coster, M. Goeman and D. Pirnay. D. Bertrand was in charge of the general coordination.

L. Van Lancker has the general responsibility of the design and of the assembly process of carbon fiber frames which will support the silicon detector of the forward CMS tracker. He is also responsible of the future RPC assembly project in Belgium. P. de Harenne and S. Hannaert participated to the cabling of the CMS detector at CERN.

G. Van Beek is responsible for the mechanics of the scintillator strips target tracker modules for OPERA. His contributions include R/D on tracker design. He is co-responsible for the trackers installation on the OPERA detector and has contributed to the conception of the procedure used for their survey. P. de Harenne participated to the emulsion bricks assembly at the LNGS. S. Hannaert has contributed to OPERA through the fabrication of mechanical parts.

J.-P. Dewulf is responsible for the development of a test DAQ system for a new TPC in the framework of the preparation of new detectors for a future ILC collider. He is involved in the design of a FPGA based board.

L. Etienne is responsible of the installation of the test station for the DOM modules (Digital Optical Modules) of the IceCube experiment. He also redeployed, after their move to a new room, the test stations of the AMANDA modules which were used for practical works of undergraduate students in physics.

J.-P. Dewulf and L. Etienne were in charge of the design and the realization of a new data acquisition system for a cosmic ray experiment to be implemented in secondary schools (OCRE-KOSMIS). This system was considerably upgraded during 2007. L. Etienne was in charge of the preparation of the scintillators used in the experiment. G. Van Beek and L. Etienne designed and build new scintillators for the muon live time experiment dedicated to the practical work of undergraduated students in physics.

In the framework of the spin-off activities related to detector developments for medical applications, J. De Bruyne and Ch. Wastiels were in charge of the technical support of the CRYSTAL CLEAR project. More particularly Ch. Wastiels maintained electronics control cards for the small PET camera.

R. Goorens took part in the organisation of the ULB master classes.

The secretarial work and the general administrative and logistic support of the experiments were accomplished by R. Alluyn, D. Peymans, in collaboration with A. De Coster, M. Goeman and D. Pirnay. D. Peymans took part in the organization of the ULB master classes and of the OPERA collaboration meeting which was held at the ULB in February 2007. A. De Coster is responsible of the library of the Institute. She also maintains the database of the physicists publications. D. Pirnay maintains the IAP website. M. Goeman is in charge of the logistic support of the CRYSTAL CLEAR project.

## VII. REPRESENTATION IN ACADEMIC COUNCILS AND COMMITTEES

### ***Daniel Bertrand***

- Responsible for the ULB Physics Department Erasmus Students Exchange Program
- Member Doctoral and DEA Commission of the Physics Department
- Chairman Physics department strategic plan commission
- Chairman ULB Personnel C4 Commission

### ***Catherine De Clercq***

- Member BaMa commissie faculteit Wetenschappen VUB
- Secretary Examencommissie Bachelor Fysica
- Secretary Examencommissie Master Fysica VUB
- Member Gelegenheidscommissie vacature ZAP in de fysica, VUB
- Member Commissie PR faculteit Wetenschappen of VUB

### ***Eddi De Wolf***

- Voorzitter van de onderwijscommissie Fysica

### ***Pierre Marage***

- President de la Commission scientifique Ecole doctorale de la Communaute francaise en Physique et Astrophysique
- Membre du Conseil d'Administration Institut national des Radioelements, Fleurus
- Membre du Comite scientifique Experimentarium de Physique de l'ULB
- President du Comite scientifique Infosciences, cellule de diffusion des sciences de la Faculte des Sciences de l'ULB
- Vice-president Centre de Culture scientifique de l'ULB a Charleroi - Parentville
- Membre du CA Altair, asbl d'Histoire des Sciences attachee a l'ULB
- Directeur de section Institut des Hautes Etudes de Belgique

### ***Stefaan Tavernier***

- Lid Bevorderingscommissie ZAP

### ***Catherine Vander Velde***

- Membre Commission de sýlection des assistants du dýpartement de physique
- Membre Commission de classement du dýpartement de physique
- Membre Commission d'attribution des crýdits pýdagogiques du dýpartement de physique

### ***Pierre Van Mechelen***

- Bureau van de onderwijscommissie Fysica

## VIII. REPRESENTATION IN SCIENTIFIC COUNCILS AND COMMITTEES

### ***Daniel Bertrand***

- Member IIHE PAI governing board
- Member Representative of the FNRS Aspera Steering Committee
- Member Representative of the FNRS ApPEC Steering Committee
- Member Representative of the FNRS DESY Experiments Finance Review Board
- Member Representative of the FNRS ILIAS Steering Committee
- Member IIHE Cern fellows Belgian selection committee

***Othmane Bouhali***

- Invited Forum International des Compétences Marocaines à l'étranger

***Peter Bruyndonckx***

- Member representative from the Crystal Clear Collaboration NEMA Animal PET Standard
- Member co- representative from the IIHE Crystal Clear Collaboration Steering Committee
- Member co- representative from the Crystal Clear Collaboration Steering Committee of the international Open Gate collaboration

***Catherine De Clercq***

- Member representative of FWO ASPERA Eranet Governing Board
- Vice-president board of the IAP 6/11 Fundamental Interactions
- Member Jury wetenschappelijke prijs SCK-CEN - Prof. Roger Van Geen
- Member FWO commissie E5 Subatomaire Fysica
- Member IISN commission des Hautes et Basses Energies
- Member NIKHEF Scientific Advisory Committee
- Member Belgian selection committee of CERN fellows,
- Member organisation committee of the Belgian-Dutch-German summer school
- Member representative of Belgium Plenary ECFA
- Member representative of the FWO ApPEC steering committee

***Gilles De Lentdecker***

- Member ULB representative Organizing Committee of the 42nd International Physics Olympiad

***Eddi De Wolf***

- Member of the International organizing committee Low-x Workshop

***Pierre Marage***

- Coorganisateur Seminaire Ilya Prigogine Penser la Science, ULB
- Membre titulaire Comite national de Logique, de Philosophie et d'Histoire des Sciences
- Member FWO - Commissie E5 (Subatomaire Fysica)
- Member SPSC - CERN

***Pascal Vanlaer***

- Member Representative of the Belgian Tier-2 computing center CMS Computing Resource Board

***Pierre Van Mechelen***

- Member of the CASTOR steering committee

***Pierre Vilain***

- Member Board of High Energy Physics section of European Physical Society

***Gaston Wilquet***

- Belgian delegate to the Advisory Committee of CERN Users (ACCU)
- Member of the Commission Hautes et Basses Energies, IISN-FNRS

## **IX. TEACHING ACTIVITIES**

### ***ACADEMIC YEAR 2006-2007***

***Daniel Bertrand***

- PHYS-F-205 "Physique 2" (36/0/0/0) BA2 Biology/Geography/Geology Full time

- PHYS 105 "Stage de laboratoire" (0/0/75/0) 1ere licence en sciences physiques Full time
- INFO 162 "Description des Ordinateurs" (45/15/0/0) Annee preparatoire a la licence en informatique en horaire decale Full time

**Peter Bruyndonckx**

- "Proefondervindelijke aspecten van de stralings- en kwantumfysica" (0/16/0/0) 2e Ba Full time
- "Inleiding tot Mathematica" (3/10/0/0) 1e Ba Full time
- "Recente ontwikkelingen in de medische fysica" (13/0/0/0) 2e GGS klinische en biologische ingenieurstechnieken Full time
- "Medische fysica" (13/13/0/0) 3e Ba Full time

**Catherine De Clercq**

- WE-DNTK-1998 "Elementaire Deeltjesfysica I" (26/0/26/0) 3BA Fysica VUB Full time
- WE-DNTK-9246 "Meten en Experimenteren" (responsable - 0/0/65) 1BA Fysica VUB Full time

**Gilles De Lentdecker**

- PHYS-F-101 "Laboratoires du cours de Physique Générale" (0/0/32/0) 2006-2007 Full time

**Olivier Devroede**

- Informatica (24) 3Ba Full time
- Informatica (24) 1BA Full time

**Eddi De Wolf**

- Kanstheorie en Statistiek, (Ba2 fysica, 6 SP)
- Theorie van de Fundamentele Wisselwerkingen, (Ma1 Fysica, 6 SP)
- Experimenteel Labo (Ma Fysica, 3 SP)
- Capita Selecta / Studentenseminarie (Ma Fysica, 3 SP, in collaboration with J.Dhondt)

**Laurent Favart**

- PHYS-F-101 "Laboratoires du cours de Physique Generale" BA1 (0/0/32/0) full time
- PHYS-F-312 "Laboratoires de Physique des Particules elementaires" BA3 phys(0/0/8) full time

**Xavier Janssen**

- PHYS-F-205 "Physique 2 - Travaux pratiques en laboratoire" (24) BA2 BIO and BA2 GEO Full time

**Joris Maes**

- WE-DNTK-9246 "Meten en experimenteren" (0/0/40/40) 1BA Full time

**Pierre Marage**

- PHYS-F-312 "Laboratoires (physique des part. elem.)" (0/0/8/0) BA-3 phys. Full time
- PHYS-F-436 "Stage de physique expérimentale des particules" (0/0/64/0) MA-1 Full time
- PHYS-F-104 "Physique generale" (48/0/0/20) BA-1 Full time
- HIST-F-101 "Histoire des Sciences" (24/0/0/0) BA Full time
- HIST-F-500 "Histoire des Sciences et Epistémologie" (24/0/0/0) MA-didact., AESS Full time

**Matthias Mozer**

- BA-3 fysica "Statistische fysica en thermodynamica (Prof. J. D'Hondt)" (0/26/0/0) Part time

**Stefaan Tavernier**

- BNEN "Radiation protection and nuclear measurement" (12+12) Interuniversitaire Masteropleiding in Nuclear Engineering Full time
- WE-DNTK-2088 "Kernfysica en toepassingen" (13/13) 3de BA Full time
- IR--12405 "Measurement techniques in nuclear and particle physics" (16/0/16/0) 1st Master of biomedical engineering (UGent-VUB) Full time

- WE-DNTK-12516 "Moderne instrumentatie in de fysica" (26/0/0/26) 1st Ma fysica Full time
- WE-DNTK-10163 "Detectie van ioniserende stralingen, klinische dosimetrie, wetgeving en kwaliteitsbewaking" (13/13) 2de Lic Full time

***Catherine Vander Velde***

- PHYS-F-443 "Travaux pratiques et stages" (0/0/12/36) AESS + MA1 physique Full time
- PHYS-F-510 "Didactique de la physique (du secondaire et du supérieur)" (36/0/0/12) AESS + MA1 physique Full time
- PHYS-F-103 "Physique" (36/0/0/20) BA1-Informatique Full time
- PEDAF-501 "Pratique réflexive (physique)" (0/24) AESS + MA1 physique Full time
- PHYS-F-511 "Travaux pratiques et stages" (0/0/0/36) AESS + MA2 physique Full time
- Coordinator "Objectif réussite - physique" (650) BA1-toutes sections Full time

***Pascal Vanlaer***

- PHYS-F-104 "Physique 1" (0/36/0/36) BA 1 Full time
- PHYS-J-102 "Physique Générale" (0/0/24/0) BA 1 Full time
- PHYS-F-101 "Physique Générale" (0/48/0/0) BA 1 Full time
- PHYS-H-303 "Projets de Physique" (0/0/0/24) BA 3 Engineers Full time

***Pierre Van Mechelen***

- Algemene Fysica IV: Beperkte Relativiteitstheorie en Elementaire-Deeltjesfysica (ba fysica, 6 stp)
- Subatomaire Fysica (ba fysica, 3 stp)
- Elementaire-Deeltjesfysica (ba wiskunde, 3 stp)
- Kanstheorie- en Statistiek (ba fysica, 6 stp)
- Kernfysica (lic fysica, 4 stp)
- Versnellerfysica (ma fysica, 3 stp)

***Petra Van Mulder***

- WE-DNTK-9246 "Meten en experimenteren" (0/0/40/40) 1BA Full time

***Pierre Vilain***

- PHYS-F-305 "Physique des particules élémentaires" (24/0/0/12) 3rd Full time
- PHYS-F-416 "Interactions fondamentales et particules" (16/0/0/0) 4th Full time

***Mateusz Wedrowski***

- WE-DNTK-2088 "Nuclear Physics and its application" (0/13/0/0) 3e Ba Full time
- IR--12405 "Nucleaire Meettechnieken" (0/13/0/0) 1e Ma Ingenieurswetenschappen Full time

***Gaston Wilquet***

- PHYS-F-312/313 "Coordination des travaux de laboratoires" (0/90/0) PHYS - BAC3 Full time
- PHYS-F-301 "Techniques de la physique expérimentale" (14/90/0) PHYS - BAC3 Full time
- PHYS-F-310/311 "Coordination des stages" (0/90/0) PHYS - BAC3 Full time

## **X. "MEMOIRES DE LICENCE" AND "LICENTIAATSVERHANDELINGEN" COMPLETED IN 2007**

***Pierre Cherelle***

- "Analyse van het effect van een Two-Higgs Doublet Model op het invariante massaspectrum van het systeem in proton-proton botsingen met de LHC" - Promotor : Jorgen D'Hondt

***Olbren Depaepe***

- "Onderzoek van de gevoeligheid van AMANDA voor Kaluza Klein donkere materie in de zon" – Promotor: Catherine De Clercq

***Vincent Dero***

- " Contribution à l'étude de la section efficace du processus de Drell-Yan au LHC" – Promotor: B. Clerbaux

***Raphael Van Roermund***

- "Etude du processus Drell-Yan dans l'expérience CMS au LHC", 21 May 2007, Promotor: D.Baye, P.Vanlaer

## **XI. SEMINARS AND ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS AND COLLABORATION MEETINGS**

### **XI.1. SEMINARS AT THE IIHE (ORGANISED BY L. FAVART)**

The IIHE had the pleasure to welcome the following invited speakers

- Dr. Matthias Mozer (Heidelberg Uni.): „Diffractive Scattering and Parton Densities at H1 »
- Dr. L. Agostino (CERN) : « Electron and Photon Energy Calibration and High Level Trigger in the CMS Experiment”
- Dr. F. Blekman (Imperial Coll. UK) : « High-multiplicity top quark physics at D-zero”
- Dr. V. Van Elewyck (IPN Orsay) : « Physics results of the Pierre Auger Observatory”
- Dr. Michel Herquet (UCL, Belgium): “The new MadGraph/MadEvent v4 : from models to detectors in one go”
- Dr. Jozsef Janicsko-Csathy (Universite de Neuchatel, CH) : « Study of neutrino interactions and background estimation in the OPERA Detector”
- Dr. X. Janssen (IIHE - ULB) : « Diffraction at HERA and the Very Forward Proton Spectrometer”
- Dr. Benjamin Fuks (Lab. de Physique Subatomique et de Cosmologie, Grenoble) : « Threshold resummation for slepton pair production at hadron colliders”
- Dr. Volker Adler (DESY) : « Optimising of Design Parameters of the TESLA Vertex Detector and Search for Events with Isolated Leptons and Large Missing Transverse Momentum with the ZEUS-Experiment (HERA II)”
- Dr. Jelena Petrovic (NIKHEF) : « Search for sources of high energy cosmic rays with the ANTARES neutrino telescope and the Auger observatory”
- Dr. Mohamed Aharrouche (LAPP - Annecy) : « Electrons at ATLAS/LHC”
- Dr. Christian Schwanenberger (Univ. of Manchester) : « Evidence for Single Top Quark Production at the Tevatron”
- Dr. Igor Ivanov (ULg) : « Central exclusive dijets at hadron colliders »
- Prof. Gianluca Cavoto (INFN - Roma La Sapienza): “Observation of D0 oscillation at B-factories”



## XI.2. ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS AND COLLABORATION MEETINGS

### ***Daniel Bertrand***

- "From AMANDA to IceCube" - Sixth International Workshop on Astroparticle Physics 05 September 2007

### ***Othmane Bouhali***

- "Grid Computing and collaboration Belgium-Morocco" - Al Ain, United Arab Emirates 27 November 2007
- "La grill de calcul Ma-Grid" - Oujda, Morocco 10 April 2007
- "The Belgian and Moroccan grid computing platform" - Fez, Morocco 04 April 2007
- "La collaboration Belgo-Marocaine" - Montpellier, France 11 December 2007

### ***Peter Bruyndonckx***

- "Influence of training data sets and DAQ set-up on monolithic block performance" - CERN 14 November 2007

### ***Olivier Devroede***

- "New web and other tools for CCC" - Madrid 07 March 2007
- "ClearPET rodent: status report" - Madrid 07 March 2007

### ***Catherine De Clercq***

- "Midterm report from Belgium" - CERN, Geneva, Switzerland 30 November 2007

### ***Gilles De Lentdecker***

- "Recent results from the Tevatron" - Gent, Belgium, Kick-off meeting of the IAP VI/11 28 February 2007

### ***L. Favart***

- "Status of the H1 Very Forward Proton Spectrometer", 15th International workshop on Deep-Inelastic Scattering (DIS2007), Munich, Germany, 16-20 April 2007
- "Diffraction and Vector Mesons: Session Summary. Part II", 15th International workshop on Deep-Inelastic Scattering (DIS2007), U.\ Klein and L.\ Favart, Munich, Germany, 16-20 April 2007
- "Diffraction and Exclusive Vector Meson Production at HERA", BARYONS 2007, Seoul, South Korea, 11-15 June 2007
- "VFPS DAQ and Trigger", "Meeting on Diffraction and Forward Physics at HERA and the LHC", Antwerpen, Belgium,, 25-26 October 2007

### ***Tomas Hreus***

- "Inclusive and Exclusive diffraction at HERA" - The VIIIth Rencontres de Moriond, QCD AND HIGH ENERGY HADRONIC INTERACTIONS 22 March 2007

### ***Daan Hubert***

- "Status: solar neutralinos 2001-2003" - IceCube Collaboration Meeting, Lake Geneva, Madison, USA 25 April 2007
- "Neutralino weights and effective volumes" - Icecube Collaboration meeting, Gent, Belgium 06 October 2007
- "Search for neutralino dark matter with the AMANDA neutrino telescope" - 30th International Cosmic Ray Conference, Merida, Mexico 09 July 2007
- "Neutralino searches with the AMANDA and IceCube neutrino telescopes" - EuroGDR SUSY 2007, Brussels, Belgium 13 November 2007

**Xavier Janssen**

- "Production diffractive de mésons rho et phi" - H1 Collaboration Meeting, Orsay, Paris, France 18 September 2007
- "Inclusive diffraction at HERA and factorisation issues" - Low x meeting 2007, Helsinki, Finland 29 August 2007

**Matthieu Labare**

- " Search for High Energy Neutrino Point Source Signal with AMANDA-IceCube Telescope", Belgian Physics Society - Antwerpen, May 2007
- "An Introduction to Neutrino Point Source Search with the AMANDA-IceCube Telescope", Joint Belgian Deutch German School - Spa, September 2007

**Joris Maes**

- "btagging efficiency determination methods - ttbar" - b Tag and Vertexing Workshop, FNAL, Chicago, USA 10 July 2007
- "General QCD background study" - Joint QCD/EWK/TOP meeting, CERN, Geneva, Switzerland 24 April 2007
- (Top Quark Analysis Framework (TQAF), CERN, Geneva, Switzerland):"Likelihood Ratio Method for Jet Combination Selection" 06 June 2007,
- (EWK/TOP Workshop, CERN, Geneva, Switzerland):"Estimating b-tag efficiency with semi-leptonic top quark pairs" 16 June 2007
- (Joint Dutch Belgian German school, Spa, Belgium):"Measuring btag efficiency in ttbar events" 08 September 2007
- (b-tag/top: estimating flavour tagging efficiencies with top events, CERN, Geneva, Switzerland):"Measurement of b tag efficiency with t-tbar events (KinFit/LLR method)" 08 October 2007,
- (b-tag/top: estimating flavour tagging efficiencies with top events, CERN, Geneva, Switzerland):"Measurement of b tag efficiency with t-tbar events (KinFit/LLR method)" 15 October 2007
- (b-tag/top: estimating flavour tagging efficiencies with top events, CERN, Geneva, Switzerland):"Status of b efficiency from mixed top-top events" 05 November 2007
- (b-tag/top: estimating flavour tagging efficiencies with top events, CERN, Geneva, Switzerland):"Measurement of b tag efficiency with t-tbar semi-leptonic decays (KinFit/LLR method)" 19 November 2007
- (Review meeting QCD/EWK/TOP, CERN, Geneva, Switzerland):"B-tag efficiency using LR method (cat.6)" 19 November 2007
- (b-tag/top: estimating flavour tagging efficiencies with top events, CERN, Geneva, Switzerland):"Measurement of b tag efficiency with t-tbar semi-leptonic decays (KinFit/LLR method)" 03 December 2007
- (Joint QCD/EWK/TOP meeting, CERN, Geneva, Switzerland):"Measurement of b tag performance with top quark events (cat.6)" 11 December 2007

**Matthias Mozer**

- "QCD Factorization in Diffraction" , Manchester, GB 19 July 2007
- "Diffractive dijets in DIS and PHP" , Munich, Germany 17 April 2007

**Alfio Rizzo**

- "Search for Neutralino Dark Matter with the AMANDA neutrino telescope and prospect for IceCube" - Sixth International Heidelberg Conference on Dark Matter in Astro & Particle Physics, Sydney (Australia) 28 September 2007
- "Search for Neutralino Dark Matter with the AMANDA neutrino telescope" - Belgian Physical Society, General Scientific Meeting - Universiteit Antwerpen, Antwerp 30 May 2007

**Robert Roosen**

- "The Very Forward Spectrometer: An Overview – Meeting on diffraction and Forward Physics at HERA and the LHC, Antwerp, Belgium, 25-26 October 2007
- "The Very Forward Spectrometer: H1 experience using Roman Pots – Atlas Collaboration meeting RP220, Saclay, Paris, France, 27 November 2007

**Stefaan Tavernier**

- "Block detectors with SiPMT's" - CERN 14 November 2007
- "Plans of Crystal Clear in FP7" - Jülich 06 February 2007

**Pascal Vanlaer**

- "Egamma status and plans" - CERN 19 July 2007
- "Egamma status and plans" - CERN 20 September 2007
- "Egamma status and plans" - CERN 09 February 2007

**Pierre Van Mechelen**

- "Physics in the forward region at the LHC, HERA and the LHC", 3rd workshop on the implications of HERA for LHC physics, , Hamburg, Germany, 12-16 March 2007
- "Proton-proton physics with CASTOR in CMS", Workshop on Low-x Physics, Helsinki, Finland, 29 August -1 September 2007
- "Forward jet production and BFKL dynamics at HERA", Workshop on Low-x Physics, , Helsinki, Finland (on behalf of the H1 Collaboration) 29 August -1 September 2007
- "Low x phenomenology with CASTOR", Meeting on Diffraction and Forward Physics at HERA and the LHC, Antwerpen, Belgium, 25-26 October 2007
- "Quarks en gluonen: bouwstenen van het proton", Inaugural Lecture, , Antwerpen, Belgium, 22 June 2007

**Petra Van Mulder**

- "Pre-approval: JES from top (AN 2007/029)" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland, 18 December 2007
- "Jet Energy Scale from top events (cat.5)" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland, 11 December 2007
- "Measuring Jet Energy Scale Corrections from Top Quark Events" - JetMET meeting, CERN, Geneva, Switzerland, 11 December 2007
- "JES from top: semi-leptonic channel update" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland, 04 December 2007
- "Jet Energy Scale from top events (cat.5)" - Review meeting QCD/EWK/Top CERN, Geneva, Switzerland, 19 November 2007
- "Extracting JES corrections using a kinematic fit" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland, 09 October 2007
- "Cat.5 2007 analyses : JES from ttbar" - Joint EWK/TOP CERN, Geneva, Switzerland 31 July 2007,
- "Final state dependent analysis tools" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland, 25 September 2007
- "MC Resolutions in Top Events" - TQAF meeting, CERN, Geneva, Switzerland 06 June 2007
- "Jet Resolution Studies for ttbar events at CMSSW131" - JetMET meeting, CERN, Geneva, Switzerland, 31 May 2007
- "Absolute Jet Energy Response from Top Quark Events and Closure Studies" - Jet Energy Scale Workshop, CERN, Geneva, Switzerland, 26 April 2007
- "Kinematic fitting in top quark events" - Joint QCD/EWK/Top Meeting, CERN, Geneva, Switzerland 13 March 2007
- "Resolutions used in a kinematic fit" - EWK/TOP Workshop, CERN, Geneva. Switzerland 16 July 2007

***Ilaria Villella***

- "JetRejector Tool Development" - JetMET CMS group meeting, CERN Geneva (Switzerland) 03 May 2007
- "Jet Rejector Tool" - JetMET CMS group meeting, CERN Geneva (Switzerland) 31 May 2007
- "Update on JetRejector Tool" - JetMET CMS group meeting, CERN Geneva (Switzerland) 12 July 2007
- "Update on Jet Rejector Tool" - JetMET CMS group meeting, CERN Geneva (Switzerland) 04 October 2007
- "Jet ID - Status of Jet Rejector Tool" - Jet Algorithms CMS group meeting, CERN Geneva (Switzerland) 16 October 2007
- "Jet Rejector Tool: Update" - Jet Algorithms CMS group meeting, CERN Geneva (Switzerland), 18 December 2007

***Li Zhi***

- "Simulation results for PET-CT" – CERN, Switzerland, 14 November 2007

**XI.3. POSTER PRESENTATIONS AT CONFERENCES, WORKSHOPS AND SCHOOLS**

***Peter Bruyndonckx***

- "Impact of read-out hardware on Neural Network performance for monolithic scintillator detectors" - Lucca, Italy 19 September 2007
- "High sensitivity PET detector design using monolithic scintillator crystals" - Belgium 16 November 2007
- "Monte Carlo study of a non-pixelated scintillator PET detector using a light sharing principle" - Hawaii, USA 28 October 2007

***Catherine De Clercq***

- "IceCube: a Neutrino Telescope in the Antarctic Ice" – Meeting of the BPS - Universiteit Antwerpen, Antwerpen 30 May 2007

**XII. SCIENTIFIC VULGARISATION AND OUTREACH ACTIVITIES**

***Daniel Bertrand***

- "Cosmic Rays Detection" - Practicals for College Pupils Whole scholar year. OCRE

***Catherine De Clercq***

- "Spookdeeltjes uit de ruimte gevangen in het Zuidpoolijs." - oral presentation 13 November 2007
- "Spookdeeltjes uit de ruimte gevangen in het zuidpoolijs: het neutrino observatorium IceCube" - Oral presentation 04 December 2007
- "Visit to the IIHE of the Atheneum van Asse" - laboratory visit 08 March 2007
- "Participation to the SIDIN information days for high schools" - information day for high school students 18 January 2007
- "Visit to VUB and IIHE of University of Leiden" - laboratory visit 22 January 2007
- "Infodag" - information day for high school students several days
- "Coordination of Dutch visits" - visits to the ULB Experimentarium several visits
- "Member of the Flemish Physics Olympiads Committee" - Physics Olympiads since 2005
- KOSMIS, kosmische stralingdetector in het secundair onderwijs

***Olivier Devroede***

- KOSMIS, kosmische stralingdetector in het secundair onderwijs – voordracht

**Eddi De Wolf**

- Alumnidag Fysica 2007

**Daan Hubert**

- "Op zoek naar donkere materie met IceCube" - Seminarie Urania sterrenwacht 11 December 2007

**Joris Maes**

- "Bezoek aan het laboratorium fysica en fysicakwis" - Meesterklassen Fysica 17 April 2007

**Pierre Marage**

- "Les Conseils Solvay, Einstein et les débuts de la physique moderne" - Université du troisième âge, antenne ULB-UCL, Woluwe-St-Lambert, 16 January 2007
- "Identité de la matière et révolutions scientifiques" - Echange et Diffusion des Savoirs, Marseille (F) 05 April 2007
- "Les Conseils Solvay et les débuts de la physique moderne" - Classes préparatoires aux Ecoles d'ingénieurs, Lycée Dumont d'Urville, Toulon (F) 06 April 2007
- "Révolutions scientifiques en physique" - Club CNRS Science - Citoyens, Annecy (F) 04 December 2007
- "L'homme qui ne portait pas de chaussettes', ou Quel Einstein célébrons-nous ?" - art. La Pensée et les Hommes n°64, pp.91-101 dec. 2007
- "Choix d'études scientifiques: ingénieurs ? diplômés en sciences ? La place des filles" - Salon de l'Etudiant organisé par le CIEP, La Louvière 10 March 2007
- "Le rôle de l'Université aujourd'hui: humanisme ou marchandisation?" - Table-ronde organisée par le Rectorat, ULB 15 October 2007

**Catherine Vander Velde**

- "Master classe de physique des particules" - Master classe 17 March 2007
- "Master classe de physique des particules" - Master classe 21 April 2007
- "Erreurs de mesure et ressort" - Encadrement de laboratoire pour les lauréats des olympiades de physique 2 April 2007
- "Vincent De Geyndt" - 1 week in the lab for a secondary school student 29 March 2007
- "Le CERN" - Conference in a Rotary section 12 November 2007

**Pascal Vanlaer**

- "Visit of secondary school students to CERN" - CERN visit 17 March 2008

**Pierre Van Mechelen**

- Open-Les namiddagen UAntwerpen

**Petra Van Mulder**

- "bezoek aan het laboratorium fysica en wetenschapsquiz" - Meesterklassen fysica 17 March 2007

**Pierre Vilain**

- "La Physique des Particules" - Master class oral presentation 3-2 and 17-3-2007
- "L'expérience OPERA" - Présentation à la presse 26 November 2007
- "L'expérience OPERA" - Interview RTBF 3 December 2007

**Gaston Wilquet**

- "Lectures on 'Le modèle du Big-Bang'" for the Master class 3 February and 17 March 2007
- "Radio interview on OPERA for Forschung Aktuell, Deutschlandfunk", 21 July 2007
- "Press meeting with the French speaking Belgian press about OPERA", 26 November 2007
- "Two radio programmes on neutrino physics for Semences de Currieux, RTBF1 radio" December 2007

## XIII. ATTENDANCE TO CONFERENCES, WORKSHOPS AND SCHOOLS

### XIII.1. CONFERENCES AND WORKSHOPS

#### ***Daniel Bertrand***

- "Sixth International Workshop in Astroparticle Physics", Faro Portugal - Oral presentation from 04 September 2007 to 09 September 2007

#### ***Othmane Bouhali***

- "CERN-UAE Workshop", Al Ain, United Arabs Emirates (UAE) - Oral presentation from 26 November 2007 to 29 November 2007
- "Congrès Nord-Sud sur la physique et la recherche", Oujda, Morocco - Oral presentation from 09 April 2007 to 13 April 2007
- "Information an Communication Technologies International Symposium", Fez, Morocco - Oral presentation Conference organisation Session chair-person from 03 April 2007 to 05 April 2007
- "L'Internet et le Grilles de calcul en Afrique", Montpellier, France - Oral presentation from 10 December 2007 to 12 December 2007

#### ***Peter Bruyndonckx***

- "46th Crystal Clear Collaboration Meeting", Madrid, Session chair-person, 07 - 08 March 2007
- "Workshop on Breast Imaging", Marseille, 25 - 26 January 2007
- "MRI-BrainPET meeting", Madrid, 06 March 2007
- "Preparation application 7th Framework Program", Jülich, 02 - 03 April 2007
- "CC Steering Committee", Madrid, 09 March 2007
- "Geant4 Training", Madrid, 06 May 2007
- "European Conference on Medical Physics", Lucca, Italy, Oral presentation 19 - 23 September 2007
- "European Nuclear Conference 2007", Belgium, Oral presentation 16 - 19 September 2007
- "47th Crystal Clear Collaboration Meeting", CERN, Oral presentation Session chair-person 14 -15 November 2007
- "CC Steering Committee", CERN, 16 November 2007
- "ClearPEM Sonic Collaboration Meeting", Marseille, 26 January 2007

#### ***Jun Dang***

- "European Conference on Medical Physics", Lucca, Italy, 19 - 23 September 2007
- "46th Crystal Clear Collaboration Meeting", Madrid, 06 - 08 March 2007

#### ***Julie Delvax***

- "H1 week", DESY, Hamburg, Germany, Oral presentation 10 - 14 December 2007
- "H1 Cross Talks 2007-The Workshop-Seminar for PhD and Diploma Students", DESY, Hamburg, Germany, Oral presentation 18 - 19 October 2007
- "Meeting on Diffraction and Forward Physics at HERA and the LHC", Antwerpen, Belgium, Oral presentation 25 - 26 October 2007
- "Collaboration Meeting", LAL, Orsay, France, 18 - 21 September 2007

#### ***Catherine De Clercq***

- "Onderzoeksnetwerken in België en in Europa: uitdagingen en kansen.", Residence Palace, Brussels, 22 May 2007
- "Euro-GDR SUSY International Meeting 07", Université Libre de Bruxelles, Brussels, Session organizer Session title: Plenary session Session chair-person, 12 - 14 November 2007
- "The European GAPP project.", Royal Belgian Institute of Natural Sciences, Brussels, 09 November 2007
- "Plenary ECFA meeting", CERN, Geneva, Switzerland - Oral presentation 30 November 2007
- "IceCube Low Energy Workshop", RWTH Aachen, Germany, 23 - 25 August 2007
- "30th International Cosmic Ray Conference", Merida, Mexico, 03 - 11 July 2007
- "IAP 6/11 Fundamental Interactions kick-off meeting", Universiteit Gent, Gent, 28 February 2007

- "General Scientific Meeting of the Belgian Physical Society", Universiteit Antwerpen, Antwerpen - Poster , 30 May 2007

***Gilles De Lentdecker***

- "MicroTCA Seminar", Versailles, Paris, France
- 23 May 2007
- "RT2007 Conference", Fermilab, Batavia (Chicago), USA, 28 April - 04 May 2007

***Olivier Devroede***

- "47th Crystal Clear Collaboration Meeting", CERN, 14 - 16 November 2007
- "European Conference on Medical Physics", Lucca, Italy, 19 - 23 September 2007
- "Geant4 Training", Madrid, 06 - 09 May 2007
- "46th Crystal Clear Collaboration Meeting", Madrid, Spain, oral presentation, 06 - 08 March 2007

***Laurent Favart***

- "15th International workshop on Deep-Inelastic Scattering", Munich (D), Oral presentation Session organizer Session title:Diffraction and Vector MesonsSession chair-person, 16 - 20 April 2007
- "BARYONS 2007", Seoul - South Korea, Oral presentation, 11 - 15 June 2007
- "Meeting on Diffraction and Forward Physics at HERA and the LHC", Antwerp (B), Oral presentation 25 - 26 October 2007

***Marleen Goeman***

- "47th Crystal Clear Collaboration Meeting", CERN, 14 - 15 November 2007
- "Crystal Clear Collaboration Steering Committee", CERN, 16 November 2007
- "46th Crystal Clear Collaboration Meeting", Madrid, 06 - 08 March 2007
- "Crystal Clear Collaboration Steering Committee", Madrid, 09 March 2007

***Thomas Hreus***

- "The VIIIth Rencontres de Moriond, QCD AND HIGH ENERGY HADRONIC INTERACTIONS", La Thuile (Aosta) – Italy, Oral presentation, 17 - 24 March 2007

***Daan Hubert***

- "30th International Cosmic Ray Conference", Merida, Yucatan, Mexico, Oral presentation 03 July - 11 July 2007
- "EuroGDR SUSY 2007 International Meeting", Brussels, Belgium, Oral presentation 12 - 14 November 2007
- "IceCube collaboration meeting", Gent, Belgium, Oral presentation 06 - 10 October 2007

***Xavier Janssen***

- "15th IEEE NPSS Real Time Conference", Fermilab, Batavia, USA, IL, 29 April - 04 May 2007
- "12th International Conference on Elastic and Diffractive Scattering", DESY, Hambourg, Germany, Session organizer Session title:lepton-proton collisions, 21 - 25 May 2007
- "International Linear Collider meeting 2007", DESY, Hambourg, Germany, 30 May - 03 June 2007
- "Low x meeting 2007", Helsinki, Finland, Oral presentation, 29 August 2007 - 01 September 2007
- "H1 Collaboration Meeting", Université de Paris Sud, Orsay, France, Oral presentation, 18 - 21 September 2007
- "EUDET Second Annual Meeting 2007", École Polytechnique, Paris, France, Oral presentation, 08- 10 October 2007
- "Meeting on Diffraction and Forward Physics at HERA and the LHC", Universiteit Antwerpen, Antwerpen, Belgique, 25 - 26 October 2007

***Cedric Lemaître***

- "46th Crystal Clear Collaboration Meeting", Madrid, 06 - 08 March 2007

**Joris Maes**

- "CMS Week", CERN, Geneva, Switzerland, Oral presentation, 10 - 14 December 2007
- "CMS Physics Week", CERN, Geneva, Switzerland, 22 - 26 October 2007
- "b Tag and Vertexing Workshop (FNAL)", CERN, Geneva, Switzerland, Oral presentation 09 - 12 July 2007
- "CMS Physics Week", CERN, Geneva, Switzerland, Oral presentation 23 - 27 April 2007

**Matthias Mozer**

- "DIS2007", Munich, Germany, Oral presentation, 16 - 20 April 2007
- "HEP2007", Manchester, UK, Oral presentation, 19 - 25 July 2007

**Nuno Pereira**

- "47th Crystal Clear Collaboration Meeting", CERN, Switzerland, 14 - 15 November 2007

**Stefaan Tavernier**

- "46th Crystal Clear Collaboration Meeting", CIEMAT, Madrid, Spain, Session organizer, Session title: Session chair-person 07 -08 March 2007
- "47th Crystal Clear Collaboration Meeting", CERN, Oral presentation, Session organizer, Session title: Session chair-person 14 - 15 November 2007
- "Crystal Clear Collaboration Steering Committee", CIEMAT, Madrid, Session organizer, Session title: 09 March 2007
- "CERIMED Executive Committee Meeting", Marseille, France, 24 January 2007
- "ClearPEM Sonic Collaboration Meeting", Marseille, France, 26 January 2007
- "ClearPEM Sonic Project", Marseille, France, 23 - 27 September 2007
- "CMS Meeting", CERN, Switzerland, 19 - 21 September 2007
- "CMS Meeting", CERN, Switzerland, 18 - 22 June 2007
- "CMS Meeting", CERN, Switzerland, 17 - 19 July 2007
- "CMS Meeting - Metzger", CERN, Switzerland, 07 February 2007
- "Crystal Clear Collaboration Steering Committee", CERN, Switzerland, Session organizer, Session title: 16 November 2007
- "CMS End First Phase Lowering Ceremony", CERN, Switzerland, 22 March 2007
- "IEEE SSS/MIC Meeting", Honolulu, Hawaii, Poster 29 October - 02 November 2007
- "Preparation application 7th Framework Program", Jülich, Germany, Oral presentation, 06 - 07 February 2007
- "Workshop on Breast Imaging", Marseille, France, 25 January 2007
- "European Nuclear Conference", Brussels, Belgium, 16 - 20 September 2007

**Catherine Vander Velde,**

- "Hadron Collider Physics Symposium 2007", Elba, Italy, 20 - 26 May 2007

**Pierre Van Mechelen**

- 3rd workshop on the implications of HERA for LHC physics, , Hamburg, Germany, 12-16 March 2007
- Workshop on Low-x Physics, , Helsinki, Finland, 29 August – 1 September 2007
- Meeting on Diffraction and Forward Physics at HERA and the LHC, , Antwerpen, Belgium, 25-26 October 2007

**Petra Van Mulder**

- "Physics at TeV colliders", Les Houches, France, 11 - 20 June 2007
- "Physics week, CMS", CERN, Geneva, Switzerland, Oral presentation, 23 - 27 April 2007
- "Top/EWK workshop + physics days, CMS", CERN, Geneva, Switzerland, Oral presentation, 16 - 18 July 2007
- "Physics week, CMS", CERN, Geneva, Switzerland, 22 - 26 October 2007
- "CMS week", CERN, Geneva, Switzerland, Oral presentation, 10 - 14 December 2007



**Pierre Vilain**

- "International Europhysics Conference on High Energy Physics", Manchester, UK, Conference organisation Session chair-person 19 - 25 July 2007

**Ilaria Villella**

- "Physics at TeV Colliders", Les Houches, France, 11 - 20 June 2007
- "CMS Physics Week", CERN Geneva, Switzerland, 23 - 27 April 2007
- "Top/ewk workshop", CERN Geneva, Switzerland, 16 - 17 July 2007
- "CMS Physics days", CERN Geneva, Switzerland, 18 - 19 July 2007
- "CMS Physics week", CERN Geneva, Switzerland, 22 - 26 October 2007

**Adler Volker**

- "CMS Week", CERN, Geneva, Switzerland, 18 - 22 June 2007
- "CMS Top Physics Workshop", CERN, Geneva, Switzerland, 16 - 17 July 2007
- "CMS Physics Days", CERN, Geneva, Switzerland, 17 - 19 July 2007
- "CMS Physics/Trigger Week", CERN, Geneva, Switzerland, 22 - 26 October 2007

**Mateusz Wedrowski**

- "47th Crystal Clear Collaboration Meeting", CERN, Switzerland, 14 - 15 November 2007
- "46th Crystal Clear Collaboration Meeting", Madrid, Spain, 06 -08 March 2007

**Els Wieërs**

- "46th Crystal Clear Collaboration Meeting", Madrid, Spain, 06 - 08 March 2007
- "47th Crystal Clear Collaboration Meeting", CERN, Switzerland, 14 - 15 November 2007

**Gaston Wilquet**

- "2007 Europhysics Conference on High energy Physics", Manchester, UK, 19- 25 June 2007
- "XIIth International Workshop on Neutrino Telescopes", Venice, Italy, Session chair-person, 6- 9 March 2006

**Li Zhi**

- "47th Crystal Clear Collaboration Meeting", CERN, Switzerland, Oral presentation, 14 - 15 November 2007
- "European Conference on Medical Physics", Lucca, Italy, 19 - 23 September 2007
- "46th Crystal Clear Collaboration Meeting", Madrid, Spain, 06 - 08 March 2007
- "Geant4 Training", Madrid, Spain, 06 - 09 May 2007

**XIII.2. SCHOOLS**

**Othmane Bouhali,**

- "Cisco Networking Academy" Brussels 05 September - 31 December 2007

**Julie Delvax**

- "School on QCD, low X physics, saturation and diffraction" Copanello, Calabria, Italy, 01 - 14 July 2007

**Tomas Hreus**

- "The 2007 European School of High-Energy Physics" Trest, Czech Republic, 19 August - 01 September 2007

**Joris Maes**

- "Joint Dutch Belgian German school" Spa, Belgium, 31 August - 11 September 2007

**Petra Van Mulder**

- "Joint Belgian Dutch German school" Spa, Belgium, 31 August - 11 September 2007

**Ilaria Villella**

- "Joint Belgian Dutch German School" Spa, Belgium, 31 August - 11 September 2007

**XIV. RESPONSIBILITIES IN EXPERIMENTS**

**Daniel Bertrand**

- Member DELPHI Collaboration Board
- Member IceCube Collaboration Board
- Member IceCube Executive committee

**Peter Bruyndonckx**

- Member Crystal Clear Collaboration Steering committee

**Catherine De Clercq**

- Principal Investigator for VUB IceCube Collaboration Board

**Gilles De Lentdecker**

- Responsible of the Tracker Geometry Validation CMS CMS Tracker Group

**Laurent Favart**

- Working Group Convener H1 Diffractive Physics Working Group

**Xavier Janssen**

- Convener H1 Diffractive Working Group

**Pierre Marage**

- Member CMS board
- Member H1 Executive Committee
- Member CMS ARC - referee paper QCD-07-003

**Stefaan Tavernier**

- Member CMS Finance board
- Member CMS Institution board
- Member CMS Tracker institution board
- Spokesperson, Chairman Crystal Clear Collaboration board
- Member CERIMED Executive committee

**Catherine Vander Velde**

- Member CMS Finance Board
- Member CMS Collaboration Board
- Member CMS Tracker Institution Board
- Member CMS Tracker Finance Board

**Pascal Vanlaer**

- Convener of E/gamma Physics Object Working Group CMS Physics

**Pierre Van Mechelen**

- CASTOR trigger responsible

***Gaston Wilquet***

- Member OPERA Collaboration Board
- Member OPERA Editorial Board

**XV. MEMBERSHIP IN ACADEMIC JURY'S**

***Daniel Bertrand***

- Master thesis O. Depaepe, VUB "Onderzoek van de gevoeligheid van AMANDA voor Kaluza Klein donkere materie in de zon", Member

***Othmane Bouhali***

- Master thesis F. Munster, ULB "Déploiement et simulation d'une grille de clau", 01 June 2007, Promotor: O. Bouhali (ULB) and C. El Amrani (UAE)
- Master thesis Y. El Yarichi, Y. Karroun, H. Mansouri, UAE "Contribution au test et à la certification de l'intergiciel européen gLite", 01 August 2007, Promotor: O. Bouhali and E. Zimanyi

***Catherine De Clercq***

- Master thesis O. Depaepe, VUB "Onderzoek van de gevoeligheid van AMANDA voor Kaluza-Klein donkere materie in de zon", Promotor

***Laurent Favart***

- PhD thesis T. Frisson Ecole Polytechnique, Paris "Mesure de luminosité pour l'expérience H1 et étude de la diffusion Compton élastique", Member
- PhD thesis S. Baudrand Université de Paris-Sud, Orsay "Mesure de la polarisation longitudinale de faisceaux de positons et d'électrons à HERA" ; Member

***Xavier Janssen***

- DEA thesis H. Salim, ULB "Production diffractive de mésons rho à HERA-2", Promotor

***Stefaan Tavernier***

- PhD thesis Andreia Trindade, Instituto superior tecnico Lisboa "Design and evaluation of a Positron Emission Tomograph for Breast Cancer Imaging", Member
- PhD thesis Pedro Rodrigues, Instituto superior tecnico Lisboa "Study and development of the Clear-PEM Trigger and Data Acquisition System", Member
- Agregaat Hoger Onderwijs Patrick Van Esch, - Habilitation Université Joseph Fourier, Grenoble I "Imagerie en neutronique thermique et détecteurs gazeux", Member

***Pierre Van Mechelen***

- PhD thesis Arne Vandenbroucke, UGent, member

***Pierre Vilain***

- A.E.S. thesis Dimitri Pourbaix, ULB "Space astrometry of unresolved binaries: from Hipparcos to Gaia", President

## **XVI. LIST OF PUBLICATIONS, REPORTS AND CONTRIBUTIONS TO CONFERENCES**

### **XVI.1. PUBLICATIONS**

#### ***A. NEUTRINO PHYSICS : CHORUS***

Associated charm production in neutrino-nucleus interactions

Kayis-Topaksu A, et al.

Eur.Phys.J.C 52 (3): 543-552 NOV 2007

Charged particle multiplicities in charged-current neutrino and anti-neutrino nucleus interactions.

A. Kayis-Topaksu et al.

Eur.Phys.J.C 51:775-785, 2007

#### ***B. NEUTRINO PHYSICS : OPERA***

The OPERA experiment Target Tracker

Adam T, Baussan E, Borer K, et al.

Nucl. Instr. Meth, A 577 (3): 523-539 JUL 11 2007

#### ***C. NEUTRINO PHYSICS : ICECUBE***

Five years of searches for point sources of astrophysical neutrinos with the AMANDA-II neutrino telescope

Achterberg A, Ackermann M, Adams J, et al.

Phys.Rev.D 75 (10): Art. No. 102001 MAY 2007

Search for neutrino-induced cascades from gamma-ray bursts with Amanda

Achterberg A, Ackermann M, Adams J, et al.

Astr. 664 (1): 397-410 Part 1 JUL 20 2007

Detection of atmospheric muon neutrinos with IceCube 9-string detector

Achterberg A, Ackermann M, Adams J, et al.

Phys.Rev.D 76 (2): Art. No. 027101 JUL 2007

Multiyear search for diffuse flux of muon neutrinos with AMANDA-II

Achterberg A, Ackermann M, Adams J, et al.

Phys.Rev.D 76 (4): Art. No. 042008 AUG 2007

#### ***D. EP PHYSICS : H1***

Dijet cross sections and parton densities in diffractive DIS at HERA.

A.Aktas et al.

JHEP 0710:042(2007), 1-32

Measurement of inclusive jet production in deep-inelastic scattering at high  $Q^{*2}$  and determination of the strong coupling.

A.Aktas et al.

Phys.Lett.B653 (2007) 134-144

Charged particle production in high  $Q^2$  deep-inelastic scattering at HERA.

F.D. Aaron et al.

Phys.Lett.B 654 (2007) 148-159

Search for baryonic resonances decaying to  $\Xi$   $\pi$  in deep-inelastic scattering at HERA.

A.Aktas et al.

Eur.Phys.J.C 52 (2007) 507-514

Tests of QCD factorisation in the diffractive production of dijets in deep-inelastic scattering and photoproduction at HERA.

A.Aktas et al.

Eur.Phys.J.C 51 (2007) 549-568

Search for lepton flavour violation in ep collisions at HERA.

A.Aktas et al.

Eur.Phys.J.C 52 (2007) 833-847

Inclusive  $D^{*+}$  Meson and associated dijet production in deep-inelastic scattering at HERA

A.Aktas et al.

Eur.Phys.J.C 51 (2007) 271-287

Diffractive open charm production in deep-inelastic scattering and photoproduction at HERA.

A.Aktas et al.

Eur.Phys.J.C 50 (2007) 1-20

Inclusive  $D^{*+}$  meson cross sections and  $D^{*+}$  Jet correlations in photoproduction at HERA.

A.Aktas et al.

Eur.Phys.J.C 50 (2007) 251-267

An Extraction Of The Skewing Factor From Desy-Hera Data

L.Favart, M.V.T. Machado and L. Schoeffel

Braz. J. Phys. 37 (2007) 798-800

### ***E. E+E- PHYSICS : DELPHI***

Study of multi-muon bundles in cosmic ray showers detected with the DELPHI detector at LEP

Abdallah J, Abreu P, Adam W, et al.

Astropart.Phys.28:273-286,2007

Search for pentaquarks in the hadronic decays of the Z boson with the DELPHI detector at LEP

Abdallah J, Abreu P, Adam W, et al.

Phys.Lett.B 653 (2-4) 151-160 SEP 30 2007

Investigation of colour reconnection in WW events with the DELPHI detector at LEP-2

Abdallah J, Abreu P, Adam W, et al.

Eur.Phys.J.C 51 (2) 249-269 JUL 2007

Z  $\gamma^*$  production in  $e^{(+)} e^{(-)}$  interactions at roots  $s=183-209$  GeV

Abdallah J, Abreu P, Adam W, et al.  
Eur.Phys.J.C 51 (3) 503-523 AUG 2007

Study of triple-gauge-boson couplings ZZZ,ZZ gamma and z gamma gamma at LEP  
Abdallah J, Abreu P, Adam W, et al.  
Eur.Phys.J.C 51 (3) 525-542 AUG 2007

Search for a fourth generation b<sup>-</sup>-quark at LEP-II at roots s=196-209GeV  
Abdallah J, Abreu P, Adam W, et al.  
Eur.Phys.J.C 50 (3) 507-518 APR 2007

### ***F. P-P PHYSICS : CMS***

CMS physics technical design report, volume II. Physics performance  
Bayatian GL, Chatrchyan S, Hmayakyan G, et al.  
Journ.of Phys. G-Nucl. & Part.Phys. 34 (6): 995-1579 JUN 2007

Addendum on high energy QCD with heavy ions  
CMS Collaboration  
J. Phys. G34 (2007) 2307-2455, CERN-LHCC 2007-009

Higgs searches at the LHC  
de Roeck Albert, Polesello Giacomo  
Comptes rendus physique, 8:9(2007), p. 1078-4097

Prediction for the lightest Higgs boson mass in the CMSSM using indirect experimental constraints.  
Buchmüller O., Cavanaugh R., de Roeck Albert, Heinerneyer S., Isidori G., Paradisi P., Weber Alfred, (et al.)  
Physics letters B, 657:1-3, p. 87-94

Prospects to study a long-lived charged next lightest supersymmetric particle at the LHC  
Hamaguchi Koichi, Nojiri Mihoko M., de Roeck Albert.  
Journal of high energy physics 3(2007), p.046,1-34

### ***G. APPLIED R&D AND SPINOFF***

Clear-PEM: a PET imaging system dedicated to breast cancer diagnostics  
M. C. Abreu, D. Aguiar, E. Albuquerque, F. G. Almeida, P. Almeida, P. Amaral, E. Auffray, P. Bento, P. Bruyndonckx, R. Bugalho, B. Carrico, H. Cordeiro, M. Ferreira, N. C. Ferreira, F. Gonçalves, P. Lecoq, C. Leong, F. Lopes, P. Lousã, J. Luyten, M. V. Martins, N. Matela, P. R. Mendes, R. Moura, J. Nobre, N. Oliveira, C. Ortigão, L. Peralta, J. Rego, R. Ribeiro, P. Rodrigues, A. I. Santos, J. C.Silva, M. M. Silva, S. Tavernier, I. C. Teixeira, J. P. Teixeira, A. Trindade, J. Trummer and J. Varela,  
Nucl. Instr. Meth, A571(1-2): 81-84 Feb 1, 2007

Long-term stability of the Clear-PEM detector modules  
Pedro Amaral, et al.  
Nucl. Instr. Meth, A571 (1-2): 488-492 Feb 1, 2007

Towards a continuous crystal APD-based PET detector design  
P. Bruyndonckx, C. Lemaitre, D. Schaart, M. Maas, D.J. van der Laan, M. Krieguer, O. Devroede and S.

Tavernier

Nucl. Instr. Meth, A571 (1-2): 182-186 Feb 1, 2007

Simulated performance of a small-animal PET scanner based on monolithic scintillation detectors.

D.J. Van der Laan, M.C. Maas, H.W.A.M. de Jong, D. R. Schaart, P. Bruyndonckx, C. Lemaitre and C.W.E. van Eijk

Nucl. Instr. Meth, A571 (1-2): 227-230 Feb 1, 2007

Investigation of an in-situ position calibration method for continuous crystal based PET detectors

P. Bruyndonckx, C. Lemaitre, D. Schaart, M. Maas, D.J. van der laan, M. Krieguer, O. Devroede and S. Tavernier

Nucl. Instr. Meth, A571 (1-2): 304-307 Feb 1, 2007

Optimization of LSO/LuYAP phoswich detector for small animal PET

Jin Ho Jung, et al.

Nucl. Instr. Meth, A571 (3): 669-675 Feb 11, 2007

Count rate performance study of the Lausanne ClearPET scanner demonstrator

Rey M, Jan S, Vieira JM, et al. (M.Krieguer)

Nucl. Instr. Meth, A571 (1-2): 207-210 Feb 1, 2007

#### ***H. OTHERS***

Inclusive production of charged hadrons in photon-photon collisions

Abbiendi G., de Roeck A., de Wolf E.A., et al., OPAL Collaboration  
Physics letters B651(2007)1/2, 92-101

Search for invisibly decaying Higgs bosons with large decay width using the OPAL detector at LEP

Abbiendi G., de Roeck A., de Wolf E.A., et al., OPAL Collaboration  
Eur.Phys.J.C 49(2) 457-472 (2007)

Measurement of the  $e^{+}e^{-} \rightarrow W^{+}W^{-}$  cross section and W decay branching fractions at LEP Abbiendi G.,

Ainsley C., de Roeck Albert, de Wolf E.A., et al., OPAL Collaboration  
European physical journal C, 52:4(2007), p. 767-785

Bose-Einstein study of position-momentum correlations of charged pions in hadronic  $Z(0)$  decays

Abbiendi G., Ainsley C., de Roeck A., de Wolf E.A., et al., OPAL Collaboration  
European physical journal C, 52:4(2007), p. 787-803

The design and performance of the ZEUS Micro vertex detector.

I.Brock et al.

Nucl.Instrum.Meth.A581(2007) 656-686

Exclusive  $\rho(0)$  production in deep inelastic scattering at HERA.

By ZEUS Collaboration (S.Chekanov et al.).

PMC Phys.A1(2007) 6

Dijet production in diffractive deep inelastic scattering at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al).

Eur.Phys.J.C52(2007) 813-832

Forward-jet production in deep inelastic ep scattering at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al).

Eur.Phys.J.C52(2007) 515-530

High-E(T) dijet photoproduction at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al.)

Phys.Rev.D76(2007) 072011

Bose-Einstein correlations of charged and neutral kaons in deep inelastic scattering at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al.).

Phys.Lett.B652(2007) 1-12

Measurement of (anti)deuteron and (anti)proton production in DIS at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al.). DESY-07-070, May 2007.

Submitted to Nucl.Phys.B

Multijet production at low  $x(B_j)$  in deep inelastic scattering at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al.).

Nucl.Phys.B786(2007) 152-180

Measurement of D mesons production in deep inelastic scattering at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al).

JHEP 0707(2007) 074

Diffractive photoproduction of  $D^{*+-}$ (2010) at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al.).

Eur.Phys.J.C51(2007) 301-315

Measurement of  $D^{*+-}$  meson production in  $e^+p$  scattering at low  $Q^{*2}$ .

By ZEUS Collaboration (S.Chekanov, V. Adler et al.).

Phys.Lett.B649(2007) 111-121

Leading neutron energy and  $p_T$  distributions in deep inelastic scattering and photoproduction at HERA.

By ZEUS Collaboration (S.Chekanov, V. Adler et al).

Nucl.Phys.B776(2007) 1-37

"An Extraction Of The Skewing Factor From Desy-Hera Data",

L. Favart, M. V. T. Machado and L. Schoeffel,

Braz. J. Phys. 37 (2007) 798-800 and [hep-ph/0511069].



## **XVI.2. CONFERENCE PROCEEDINGS**

### **A. APPLIED R&D AND SPINOFF**

High sensitivity PET detector design using monolithic scintillator crystals

P. Bruyndonckx, et al.

Proceedings of European nuclear conference 2007, 16-20 September 2007, Brussel, Belgium

Impact of training data composition and DAQ read-out on performance of neural network based positioning algorithms for monolithic scintillator block detectors.

P. Bruyndonckx, et al.

Proceedings of the IEEE nuclear science and medical imaging conference, 28/10 - 3/11, 2007, Hawaii, USA

Evaluation of monolithic detector blocks for high-sensitivity PET imaging of the human brain

P. Rato Mendes, et al.

Proceedings of the IEEE nuclear science and medical imaging conference, 28/10 - 3/11, 2007, Hawaii, USA

Performance evaluation of a high-resolution positron emission tomograph based on monolithic Scintillator Detectors

M.C.Maas, et al.

Proceedings of the IEEE nuclear science and medical imaging conference, 28/10 - 3/11, 2007, Hawaii, USA

High sensitivity PET detector design using monolithic scintillator crystals

European Nuclear Conference 2007, 16-20 September 2007, Brussel, Belgium 2006

Impact of read-out hardware on neural network performance for monolithic scintillator detectors

Xth EFOMP (European federation of organisations for medical physics) congress 2007, 20-22 September, Pisa Italy 2006

Monte Carlo study of a non-pixelated scintillator PET detector using a light sharing principle

IEEE Nuclear Science and Medical Imaging conference, 28/10 - 3/11, 2007, Hawaii, USA

## **XVI.3 REPORTS**

### **A. CMS NOTES**

Prospects for diffractive and forward physics at the LHC

M. Albrow et al.

CMS NOTE 2007-02, CERN-LHCC-2006-039, CERN-LHC-G-124

CMS computing, software and analysis challenge in 2006 (CSA06) summary

The CMS Collaboration

CMS NOTE 2007-006

Adaptive vertex fitting

R. Fruehwirth, W. Waltenberger, P. Vanlaer

CMS NOTE 2007-008

Tracker operation and performance at the magnet test and cosmic challenge

The Tracker Collaboration. P.Vanlaer  
 CMS NOTE 2007-029

The CMS magnet test and cosmic challenge (MTCC phase I and II)  
 CMS Collaboration  
 CERN-LHCC 2007-01

CMS computing, software and analysis challenge in 2006 (CSA2006)  
 CMS Collaboration  
 CERN-LHCC 2007-010

CMS expression of interest in the SLHC  
 CMS Collaboration  
 CERN-LHCC 2007-14

CMS high level trigger  
 D.Acosta et al.  
 CERN-LHCC 2007-021  
 CMS-AN 2007-009

Dijet resonance analysis with CMSSW 1.2.0  
 M. Cardaci, B. Bollen and R. Harris  
 CMS-AN 2007-016

Towards a measurement of the inclusive  $W \rightarrow \mu \nu$  and  $Z \rightarrow \mu^+ \mu^-$  cross sections in pp collisions at  $\sqrt{s} = 14$  TeV  
 N.Adam et al.  
 CMS-AN-2007-031

Search for the Higgs boson in the  $WW^{(*)}$  decay channel with the CMS experiment  
 C.Charlot et al.  
 CM- AN-2007-037

CMS search plans to new physics using dijets  
 M. Cardaci et al.  
 CMS-AN-2007-039

CMS Search plans and sensitivity to new physics using dijets  
 CMS Collaboration  
 CMS PAS SBM-07-001