



ANNUAL REPORT 2009

INTER-UNIVERSITY INSTITUTE
FOR HIGH ENERGIES

UNIVERSITÉ LIBRE DE BRUXELLES,
UNIVERSITÉ D'EUROPE



Vrije Universiteit Brussel



ANNUAL REPORT 2009

D. Bertrand - C. De Clercq
Directors

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

CONTENTS

I.	EPS PRIZE TO GARGAMELLE COLLABORATION FOR WEAK NEUTRAL CURRENT	6
II.	INTRODUCTION	7
II.1	U.L.B.	7
	II.1.1 ACADEMIC AND SCIENTIFIC PERSONNEL	7
	II.1.2 ENGINEERS, TECHNICAL AND LOGISTIC PERSONNEL	8
II.2	V.U.B.	8
	II.2.1 ACADEMIC AND SCIENTIFIC PERSONNEL	8
	II.2.2 ENGINEERS, TECHNICAL AND LOGISTIC PERSONNEL	9
III.	RESEARCH ACTIVITIES IN PARTICLE AND ASTROPARTICLE PHYSICS	10
III.1	NEUTRINO PHYSICS	10
	A. THE OPERA EXPERIMENT (CERN CNGS1).	10
	B. THE ICECUBE EXPERIMENT	12
III.2	STUDY OF $E^+ E^-$ ANNIHILATION AT LEP – THE DELPHI EXPERIMENT	15
III.3	STUDY OF EP COLLISIONS AT HERA – THE H1 EXPERIMENT	16
III.4	STUDY OF PP COLLISIONS AT LHC – THE CMS EXPERIMENT	18
IV.	APPLIED R&D AND SPIN-OFF	21
IV.1	DATA ACQUISITION R&D PROJECT	21
IV.2	DEVELOPMENT OF NEW SCINTILLATION MATERIALS AND OF RADIATION DETECTORS FOR BIOMEDICAL IMAGING APPLICATIONS – THE CRYSTAL CLEAR PROJECT.	23
V.	COMPUTING AND NETWORKING	26
	A. IIHE PERSONNEL	26
	B. LOCAL CLUSTERS	27
	C. LARGE-SCALE COMPUTING	27
VI.	THE INTER-UNIVERSITY ATTRACTION POLE (IAP) IN FUNDAMENTAL INTERACTIONS	29
VII.	TECHNICAL AND ADMINISTRATIVE WORK	30
VIII.	SYMPOSIUM IN HONOUR OF STEFAAN TAVERNIER	31
IX.	REPRESENTATION IN ACADEMIC COUNCILS AND COMMITTEES	32

X. REPRESENTATION IN SCIENTIFIC COUNCILS AND COMMITTEES	32
XI. TEACHING ACTIVITIES - ACADEMIC YEAR 2008-2009	33
XII. MASTER AND PHD THESES COMPLETED IN 2009	35
XII.1 MASTER THESES	35
XII.2 PHD THESES	35
XIII. SEMINARS AND ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS AND COLLABORATION MEETINGS	35
XIII.1 SEMINARS AT THE IIHE (ORGANISED BY L. FAVART)	35
XIII.2 SEMINARS	35
XIII.3 ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS	36
XIII.4 POSTER PRESENTATIONS AT CONFERENCES, WORKSHOPS AND SCHOOLS	38
XIII.5 PRESENTATIONS AT COLLABORATION MEETINGS	38
XIV. SCIENTIFIC VULGARISATION AND OUTREACH ACTIVITIES	40
XV. ATTENDANCE TO CONFERENCES, WORKSHOPS AND SCHOOLS	41
XV.1 CONFERENCES AND WORKSHOPS	41
XV.2 SCHOOLS	45
XV.3 TECHNICAL TRAINING	45
XVI. RESPONSITIBILITIES IN EXPERIMENTS	45
XVII. MEMBERSCHIP IN ACADEMIC JURY'S	46
XVIII. LIST OF PUBLICATIONS, REPORTS AND CONTRIBUTIONS TO CONFERENCES	47
XVIII.1 PUBLICATIONS	47
A. NEUTRINO PHYSICS : OPERA	47
B. NEUTRINO PHYSICS : ICECUBE	47
C. EP PHYSICS : H1	47
D. D. E+ E- PHYSICS : DELPHI	48
E. P-P PHYSICS : CMS	49
F. APPLIED R&D AND SPINOFF	49
XVIII.2 CONFERENCE PROCEEDINGS	50

A. APPLIED R&D AND SPINOFF	50
-------------------------------	----

XIX. CMS NOTES	50
-----------------------	-----------

I. EPS PRIZE TO GARGAMELLE COLLABORATION FOR WEAK NEUTRAL CURRENT



The EPS-High Energy and Particle Physics Prize was awarded in 2009 to the Gargamelle Collaboration for the discovery of the weak neutral current. The IIHE was involved in this collaboration which, on 3 September 1973, published two papers in the same issue of Physics Letters, one on neutral currents involving electrons, the other on neutral current interactions with hadrons. From left to right on the picture are the IIHE members who were contributing to this research: P. Vilain, W. Van Doninck, Gh. Coremans, J. Sacton and J. Lemonne

II. INTRODUCTION

The work presented in this report is supported by the Université Libre de Bruxelles (ULB), the Vrije Universiteit Brussel (VUB), the Fonds de la Recherche Scientifique (F.R.S-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.

Here follows the list of scientists, engineers, technical and logistic personnel who have contributed to the various activities of the Institute in 2009.

II.1 U.L.B.

II.1.1 Academic and Scientific Personnel

S. Bechet (doctorant FRIA)
 D. Bertrand (directeur de recherche F.R.S.-FNRS ; chargé de cours à temps partiel)
 E. Chabert (post-doc PAI)
 O. Charaf (doctorant IISN)
 B. Clerbaux (chercheur qualifié F.R.S.-FNRS ; chargé de cours à temps partiel)
 G. De Lentdecker (chercheur qualifié F.R.S.-FNRS)
 J. Delvax (boursière FRIA)
 V. Dero (doctorant IISN)
 M. Dierckxsens (chercheur BELSPO since October 2009)
 S. Elgammal (doctorant IISN till November 2009)
 L. Favart (chercheur qualifié F.R.S.-FNRS till September 2009 ; maître de recherche F.R.S. FNRS since October 2009 ; chargé de cours à temps partiel)
 A. Gay (chargé de Recherches F.R.S.-FNRS since October 2009)
 G. Hammad (boursier FRIA)
 K. Hanson (chargé de cours)
 T. Hreus (post-doc PAI; chargé de Recherches F.R.S.-FNRS since October 2009)
 X. Janssen (chercheur F.R.S.-FNRS till September 2009)
 M. Labare (doctorant PAI)
 P. Marage (professeur ordinaire)
 A. Marotta (chercheur PAI since October 2009)
 Y. Piersaux (collaborateur scientifique)
 J. Sacton (professeur émérite)
 Q. Swillens (boursier FRIA)
 R. Toncelli (collaborateur scientifique)
 C. Vander Velde (professeur)
 P. Vanlaer (1^{er} assistant)
 P. Vilain (maître de recherche F.R.S.-FNRS ; chargé de cours temps partiel ; professeur de l'Université since October 2009)
 G. Wilquet (professeur de l'Université)

II.1.2 Engineers, Technical and Logistic Personnel

P. De Harenne (technicien)
 L. Etienne (ingénieur)
 M. Frère (informaticien since November 2009)
 S. Gérard (informaticien)
 F. Pero (secrétaire since February 2009)
 D. Peymans (secrétaire)
 S. Rugovac (informaticien)
 E. Torisaen (informaticien)
 G. Van Beek (ingénieur)
 R. Vanderhaeghen (technicien)
 Y. Yang (ingénieur, support logistique)

II.2 V.U.B.

II.2.1 Academic and Scientific Personnel

V. Adler (postdoctoraal onderzoeker FWO)
 S. Beauceron (postdoctoraal onderzoeker FWO)
 S. Blyweert (wetenschappelijk medewerker since October 2009)
 D. Bose (postdoctoraal onderzoeker FWO since November 2009)
 P. Bruyndonckx (10% docent)
 F. Ceccopieri (postdoctoraal onderzoeker IUAP since October 2009)
 J. Dang (wetenschappelijk medewerker China Scholarship Council till September – Bilateraal akkoord Vlaanderen-China since October 2009))
 C. De Clercq (hoofddocent)
 O. Depaepe (IWT specialisatiebeurs till July 2009)
 O. Devroede (wetenschappelijk medewerker FWO)
 J. D'Hondt (docent postdoctoraal onderzoeker FWO till September 2009)
 D. Hubert (wetenschappelijk medewerker till May 2009 – postdoctoraal onderzoeker from July till August 2009)
 A. Kalogeropoulos (wetenschappelijk medewerker FWO since August 2009)
 J. Lemonne (emeritus gewoon hoogleraar)
 J. Maes (IWT specialisatiebeurs)
 M. Maes (wetenschappelijk medewerker since October 2009)
 M. Mozer (wetenschappelijk medewerker : FWO till September - IUAP since October 2009)
 N. Pereiro (wetenschappelijk medewerker GOA till March – FWO since April till November 2009)
 A. Rizzo (wetenschappelijk medewerker FWO till November 2009 – IUAP since December 2009)
 R. Roosen (onderzoeksdirecteur FWO)
 E. Strahler (postdoctoraal onderzoeker IUAP since August 2009)
 S. Tavernier (gewoon hoogleraar till September, emeritus gewoon hoogleraar since October 2009)
 W. Van Doninck (onderzoeksdirecteur FWO, on leave of absence at CERN)
 N. Van Eijndhoven (hoogleraar since October 2009)
 P. Van Mulders (IWT specialisatiebeurs)
 I. Villella (wetenschappelijk medewerker: FWO till September 2009 – IUAP since October 2009)
 M. Wedrowski (wetenschappelijk medewerker Bilateraal akkoord Vlaanderen-Polen)
 L. Zhi (wetenschappelijk medewerker Bilateraal akkoord Vlaanderen-China since July 2009)

II.2.2 Engineers, Technical and Logistic Personnel

J. Debruyne (50% - technician)
 A. De Coster (technician; 6 months 100%; 6 months 50%)
 M. Goeman (technician)
 R. Goorens (50% - ingénieur)
 S. Hannaert (technician)
 A. Ouchene (technician)
 D. Pirnay (50% - technician)
 R. Vandenbroucke (informaticus)
 L. Van Lancker (ingénieur)
 C. Wastiels (50% - technician)

III. RESEARCH ACTIVITIES IN PARTICLE AND ASTROPARTICLE PHYSICS

III.1 NEUTRINO PHYSICS

A. *THE OPERA EXPERIMENT (CERN CNGS1).*

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

The OPERA experiment aims at detecting for the first time the appearance of ν_τ in a ν_μ beam and to confirm the oscillation parameters indicated by the study of atmospheric neutrinos. The detector is installed in the underground Gran Sasso Laboratory (LNGS) on the axis of the CNGS neutrino beam produced at CERN, 730 km away. The design of the detector takes into account two conflicting requirements: a large target mass, to cope with the small intercepted neutrino flux, and a micrometric resolution, to allow the detection of the short-lived tau lepton. The target is made of 150000 basic units, called bricks, each consisting of 56 lead plates of 1 mm thickness interleaved with emulsion films, for a total weight of 1250 tons. It is instrumented with 124 layers of plastic scintillator strips to measure the trajectory of charged particles and locate the brick where a neutrino interaction occurred. The instrumented target is divided into two identical super-modules. Downstream of each of these, a magnetic spectrometer is used to measure the momentum of the penetrating muons.

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 review of design of the OPERA detector and a report on the technical performance of its various components has been published:

The OPERA experiment in the CERN to Gran Sasso neutrino beam
R. Acquafredda et al. JINST 4 (2009) P04018

The first physics run took place in 2008 with a fully operational detector with however only 40% of the nominal number of protons ejected on the neutrino target due mainly to a very poor efficiency of the CERN accelerator complex at the beginning of the run. In 2009, this number has reached 78%. Both runs have lasted about 170 days where 200 days were originally expected.

About 4000 interactions have been registered in the target. The analysis of the data acquired in 2008 is essentially completed and that of 2009 is progressing well. The expected number of observed ν_τ CC interactions in this sample is about 2.5. Together with the location of new events in the bricks, the items on which most efforts are being brought are the measurements of the detection efficiencies and of the background based on real data. In particular, 20 charm particle decays with topology very similar to ζ^- decays, similar mass, lifetime and decay modes, have been observed and analysed.

A preliminary qualitative analysis of the 2007 and early 2008 data, demonstrating the relevance of the experimental procedure, has been published in 2009:

Detection of neutrino interactions in the emulsion/lead target of the OPERA experiment
N. Agafonova et al. JINST 4 (2009) P06020

The study of high energy muons and neutrinos produced in cosmic ray interactions in the atmosphere is a very valuable by-product of this underground experiment. The flux ratio of positively to negatively charged muons has been measured with an unprecedented precision in the high energy region of 1.5 to 2 TeV. The study will be resumed in 2010.

The results have been accepted for publication:

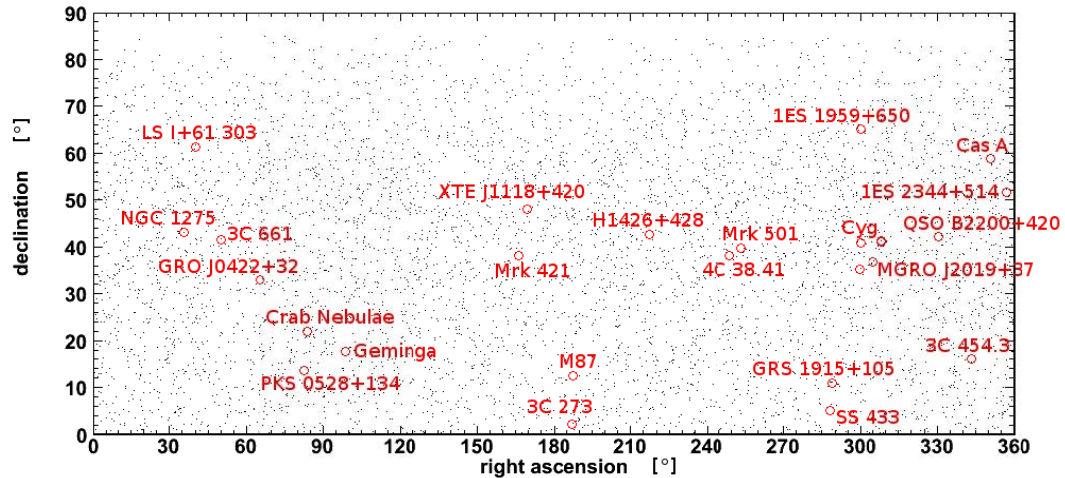
Measurement of the atmospheric muon charge ratio with the OPERA detector
N. Agafonova et al. Accepted for publication by EPJ

The experiment is scheduled to run until 2012 and to collect about 30000 neutrino interactions in the bricks, of which a dozen are expected to be identified as ν_τ charged current interactions.

The OPERA Collaboration includes about 200 physicists from 33 institutions in 13 countries. One of us (G. W.) has been the Chairman of the OPERA Collaboration Board and of the Editorial Board in 2009.

B. THE ICECUBE EXPERIMENT

(D. Bertrand, S. Bechet, D. Bose, C. De Clercq, D. Diederickx, M. Dierckxsens, M. Frère, K. Hanson, M. Labare, A. Marotta, A. Rizzo, E. Strahler and N. Van Eijndhoven)



Skymap of events from the AMANDA-II final neutrino data sample. The red sources are 26 candidate sources of TeV neutrinos the sky locations of which have been additionally analyzed for excess.

The IceCube detector at the geographic South Pole is a facility constructed to discover and study the feeble fluxes of very high energy (TeV to PeV scale) neutrinos of cosmic origin. Theoretical models of neutrino production at sites such as the cores of active galaxies (AGNs) or within the enigmatic objects that produce gamma ray bursts predict event rates on the order of 1 per km² per year. Thus the IceCube detector has been designed to instrument 1 cubic kilometer of glacial ice with sensitive photomultipliers which see the Cherenkov photons radiated by neutrino-induced charged leptons (electrons, muons, and taus). The grand scale is achieved by deploying these photomultipliers along strings in the deep ice and at large spacing: each string is instrumented with 60 photomultipliers at 17 meter spacing between 1450 and 2450 meters depth below the South Pole surface and the strings themselves are separated by 125 m in a hexagonal lattice. The photomultipliers and the associated analog and digital signal capture electronics are encased in rugged pressure spheres called DOMs (Digital Optical Modules).

As of early 2010 IceCube has completed its 6th deployment season bringing the cumulative number of strings in the ice to 79 and the number of DOMs in the deep ice to 4740. The in-ice array includes a more densely-instrumented section at the bottom center which contains 6 strings of special high-efficiency photomultipliers and which is called the "Deep Core." Because of the surrounding instrumentation which can be used as a veto for the major background source that is the constant flux of down-going cosmic ray muons which produce 2500 event triggers per second in the current detector, this Deep Core is particularly suited to the detection of low-energy phenomena such as neutrinos from dark matter annihilations. The ULB and VUB groups at the IIHE were major contributors to the construction of this Deep Core. With the last deployment in the 2009-2010 polar season, all six Deep Core strings have been set in place enabling nearly the full physics potential of the IceCube array in the 2010 run estimated to begin early April 2010. The final 7 strings will be deployed in 2010-2011 thus completing the construction phase of the experiment.

IIHE Data Analysis Topics and Collaboration Service Activities

The IceCube detector has been successfully operating since 2008 when the 40-string configuration known as IC40 was commissioned. The filtered and processed data from IC40 and the

following year's 59-string run is now available online in the IceCube data warehouse and is currently being analyzed by the collaboration. In 2009, the IIHE IceCube group was pursuing the following science goals with these data sets:

- **Search for point sources of high-energy neutrinos**

This is a core topic for IceCube, one which fundamentally drove the design of the array. Astrophysical neutrinos of TeV scale energy from intense high-energy cosmological objects are predicted by many authors¹ to produce observable events in quantity within kilometer-class observatories such as IceCube. The charged leptons which are detected can be traced back to point positions on the celestial sphere and in this manner such sources if detected would appear above the background of terrestrial atmospheric neutrinos as "hot spots" on the sky map. The fluxes are very weak, however, and so statistical techniques must be developed which correctly estimate signal significance in the presence of high background noise. A technique to control the rate of false positives using the full data set of high-energy neutrino candidate events from IceCube's predecessor array, AMANDA, has been the subject of a recently completed Ph.D. thesis in the ULB group (M. Labare, "Search for Cosmic Sources of High Energy Neutrinos with the AMANDA-II Detector" (2010)).

- **Indirect Searches for Dark Matter**

There is a preponderance of evidence that suggests that the majority of matter in the Universe is non-baryonic dark matter. The nature of this material remains one of the great mysteries in modern astrophysics, however favored theories propose that it is composed of stable supersymmetric particles. These particles may become gravitationally bound in massive astrophysical objects such as our Sun, eventually losing energy and coming to rest at the center of the objects where they will annihilate with their antiparticles producing non-supersymmetric particles such as neutrinos. These neutrinos are detectable in observatories like IceCube. Two VUB Ph.D. students were engaged in research in this domain in 2009, one having completed a Ph.D. thesis that year (Daan Hubert, "Search with the AMANDA detector for neutralino dark matter in the Sun." (2009)), and the other expected to finish by mid-2010.

- **Tau Neutrinos**

Ultrahigh-energy tau neutrinos have unique event signatures which help distinguish them from the muon background. In addition, whereas normally neutrinos in excess of 100's of TeV are unable to penetrate the full diameter of the Earth, the short tau decay length gives rise to a regeneration of tau fluxes transiting the Earth so that very high energy sources at high declinations are still visible. Finally, tau neutrinos are virtually non-existent in atmospheric neutrino fluxes so that this irreducible background which normally sets the floor for diffuse neutrino searches is eliminated. These properties make taus an extremely promising channel for such analyses. The IceCube group at the IIHE is active in this physics working group.

- **Search for Neutrinos from GammaRay Bursts**

In October 2009 a new research activity was started, which is financed by an FWO Odysseus I grant (2009-13). This new group is lead by Nick Van Eijndhoven and will pursue research in th domain of Gamma Ray Bursts.

¹ See, for example, Halzen et. al. PRD 78 063004 (2008)

IceCube Service Activities

Each collaborating institution must contribute to common pool of tasks required to maintain and operate the detector, and understand the data streaming out of it. Brussels plays a major role in the IceCube data acquisition system and detector operations group. In addition, Monte Carlo simulation requires vast and distributed computing resources and each institution is requested to contribute computing cycles from local cluster machines where possible. Brussels has been working with the simulation production leads in order to take advantage of computing resources at the institute, at the university, and also in the BEgrid. The IIHE also plays a major role in the commissioning of DeepCore.

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

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

Nine years after the end of the data taking, the DELPHI collaboration is pursuing the analysis of the e^+e^- interaction at center of mass energies between 161 and 209 GeV (LEP II experiment).

These last years, the physicists of the laboratory were mainly involved in the analysis of the tau lepton production and decay properties, the study of the W polarisation and the estimation of the charged triple-gauge-boson couplings. A total of 4 papers were published in 2009 among which we can mention the following results:

- Correlations between polarisation states of W particles in the reaction $e^+e^- \rightarrow W^+W^-$ at LEP2 energies 189-209 GeV: In this study, the probabilities of the two W particles occurring in the joint polarisation states transverse-transverse (TT), longitudinal-transverse (LT) and longitudinal-longitudinal (LL) have been determined using the final states $WW \rightarrow l\nu q\bar{q}$ ($l = e, \mu$). The two-particle joint polarisation probabilities, i.e. the spin density matrix elements $\rho_{TT}, \rho_{LT}, \rho_{LL}$ are measured as functions of the W production angle, θ_W , at an average reaction energy of 198.2 GeV. The results are in agreement with the Standard model predictions. The related polarisation cross-sections are also measured.

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

(F. Ceccopieri, J. Delvax, E. De Wolf, L. Favart, T. Hreus, X. Janssen, P. Marage, M. Mozer, B. Roland, R. Roosen, D. Sunnar, and P. Van Mechelen)

After 15 years of successful service, the HERA accelerator was shutdown permanently in July 2007 and the HERA experiments were dismantled in the subsequent year 2008. During its lifespan between 1992 and 2007, a total luminosity of about 500 pb^{-1} was accumulated. The analysis of the collected data is still ongoing and is very actively pursued (more than 100 FTE in 2009).

Activities of the IIHE group

The main activities of the group are related to the VFPS project. Primary issues before to any physics analysis which were addresses are related to track reconstruction, determination of the proton momentum and background estimates:

- A detailed study of the fibre efficiencies in the Roman pots has shown that the mean efficiency for the VFPS track reconstruction is 96%.
- Using all detailed beam- and Roman pot position information an approximate method was worked out allowing an estimation of the proton energy to a precision of few per mil.
- Background due to tracks recorded by the VFPS in conjunction with a non-diffractive DIS event was estimated by studying triggers in time slices around the physical time slice and found to be less than 2%.

These studies have led to a first measurement of the diffractive proton structure function, F_2^{D3} , the results of which have been presented to the H1 collaboration and complement existing data. These data are presently used in a QCD analysis checking the compatibility between the existing and new data.

A second analysis, studying dijet events in diffractive deep inelastic scattering and in photo-production, is in progress. It will shed further light on the factorisation breaking observed in photo-production by measuring the 4-momentum transfer using the VFPS.

The latter analysis will require the reconstructed proton momentum as obtained from the final calibration method. This method uses the a neural net, trained using the beam optics, to reconstruct the proton momentum.

The calibration is operational but is actually under scrutiny for stability regarding the variation of the input parameters in different run periods.

In parallel to the VFPS project other data analyses have been completed:

- a comprehensive study on rho and phi vector meson production (paper submitted)
- Measurement of $K^*(892)$ Production in Deep Inelastic ep Scattering with the H1 Detector at HERA (PhD defended in June 2009)

During 2009, H1 published a total of 11 articles in international journals. The most important results are:

- Proton structure
Combination of existing data with a new measurement of the inclusive ep scattering cross section at low x and Q^2 has resulted in precision of at most 2%

- Heavy quarks and hadronic final state
Parameters of the charm fragmentation function using D^* mesons production measurement in deep-inelastic scattering. A dependence is found in the presence or absence of a jet containing the D^* meson.
- Studies of neutral strange hadrons in deep-inelastic scattering and ρ^0 , K^{*0} and Φ mesons in photo-production has been measured and compared to hadro-production models and to e^+e^- , pp and to heavy-ion experimental results.
- An upper limit on the top quark production cross section via flavour changing neutral current processes of 0.25 pb has been established at 95% CL.
- Several results on searches have been published based on the full H1 statistics, they provide more restrictive limits on: excited quarks and multi-lepton production at high transverse momenta. An analysis of general search for new phenomena has also been published.

In 2009, for the first time H1/ZEUS have combined their data and published the combined results. The topics covered are:

- Multi-Leptons with High Transverse Momentum at HERA
- Events with an Isolated Lepton and Missing Transverse Momentum and Measurement of W Production at HERA
- Combined Measurement and QCD Analysis of the Inclusive ep Scattering Cross Sections at HERA

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

(V. Adler, E. Chabert, O. Charaf, B. Clerbaux, G. De Lentdecker, V. Dero, O. Devroede, J.P. Dewulf, J. D'Hondt, Sh. Elgammal, A. Gay, 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).

Top Quark Physics

The change in the planning of the first LHC runs from collision energies of 14 to 10 TeV and further down to 7 TeV, results in a smaller set of top quark pair events to be observed within the proton collisions of the first physics runs. Therefore the members of the IIHE have studied if their analyses methods can be applied on the envisaged smaller dataset. When needed the analysis strategy was adapted to the new experimental settings. The cross section for top quark pair production for the LHC at 7 TeV centre-of-mass energy, is 95 pb according to the Leading-Order MadGraph event generator. With 100pb of integrated luminosity expected to be accumulated in 2010, this would result in 9500 top quark pair events. We intend to analyze mainly the decay channel $t\bar{t} \rightarrow bWbW \rightarrow bq\bar{q}b\mu\nu$ that has a branching ratio of about 15%, resulting in about 1400 expected events before the trigger and event selection. The combined trigger and event selection efficiency is usually about 10%, hence 140 events are expected at Leading-Order cross section for physics analysis.

A crucial pre-requisite to analyse the data is to validate the performance of the techniques that are deployed for this purpose. The IIHE is a key player in the development of methods to commission the tools needed to study top quark physics. This includes the implementation of an automated DQM framework to monitor the quality of the coming collision data. Members of the IIHE have also analysed the cosmic data accumulated with the CMS experiment. The reconstruction performance of muons and the appearance of fake jets were studied.

We continued to develop data-driven methods to estimate the main backgrounds to top quark pairs. A so-called ABCD method was implemented not only to estimate the QCD multi-jet cross section after the event selection, but also to determine the shape of specific kinematic variables relevant for physics studies. To estimate the level and kinematic shape of processes with W production associated with jets, a multi-dimensional fit was designed. The fit takes as input the observed number of events in the selected data in different bins of jet multiplicity and b-tag multiplicity. The parameters of the fit determined are not only the amount of W+jets and top quark pair events present in the data, but also for example the b-tagging and mis-tagging efficiencies. This procedure is tested with simulated collisions and developed to be applied on the first 7 TeV collisions of the LHC.

The calibration techniques developed to measure the jet energy scale and the b-tagging efficiency, have been tested successfully on the expected small datasets. The novel methods designed for this purpose are fully data driven and therefore do not depend on the assumptions taken when simulating events. It has been shown that with the expected data in 2010 we can calibrate the energy of light quark jets to better than 1%, and the energy of bottom quark jets to about 1.5%. Our method has therefore the best potential performance. Also the b-tagging efficiency can be estimated from data with an uncertainty of about 3%. Both techniques rely on the constraints present in the known physics of the top quark processes. For example the masses of the top quark and the W boson which are well measured by previous experiments, but also on the Standard Model prediction that a top quark decays for about 100% of the time into a bottom quark and a W boson.

The next step will be to use these techniques in a multi-dimensional analyse, and estimate the Standard Model assumptions together with the calibration factors. These methods are being developed to search for top quark decays not in agreement with the Standard Model prediction, and to search for possible fourth generation quarks at a different mass compared to the top quark itself.

The angular distributions of the top quark pair decays in the proton collisions are a rich domain to test the key assumptions of the Standard Model. Basic quantum mechanics for example predicts a correlation between the spins of the top and anti-top quarks. This was never observed in previous experiments because it only appears in very precise measurements of the angular distributions. We have developed a new method to measure these distributions without depending strongly on the assumptions made in the simulation. The method aims to compare data directly to data, namely to compare a sample where the spin correlations are predicted to be depleted compared to a sample where they are enhanced. The method is tested on simulated proton collisions and we concluded that the CMS experiment has the potential to observe these spin correlations, although maybe not within the first physics runs planned in 2010.

A general and novel strategy to test the predictions of the Standard Model in top quark pair events is also developed by the members of the IIHE. The most important kinematic variables reflecting the top quark pair topology and potentially sensitive to new physics phenomena have been selected. The Standard Model background in these differential distributions is being estimated in a data-driven way, and systematic uncertainties are being studied. A combined goodness-of-fit method is developed and tested on simulations to conclude if the predictions of the Standard Model agree with the observed data or not. Also specific mSUGRA models are studied with these variables to quantify how sensitive we are with this method to discover the phenomena of these models. The techniques are ready to be applied on the data expected from the first physics runs of the LHC.

Search for high mass resonances

High mass resonances decaying into electron pairs provide some of the most important discovery potentials beyond the Standard Model at the LHC. They are predicted in various models as for example massive gravitons or new massive gauge bosons in the framework of extra spatial dimension models, as well as new heavy Z bosons in Grand Unified Theories. A discovery in the electron pair channel is possible for certain models after the first year of LHC running at center-of-mass energy of 7 TeV, with an integrated luminosity of 1 fb^{-1} .

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 HEEP (High Energy Electron Pairs) working group, which has defined the strategy to adopt with the very first data (low luminosity and not well understood detector) to allow a fast discovery of high mass resonances in startup condition. A first complete analysis was published in 2008 for proton-proton collision at 14 TeV. In 2008/2009, the analysis was updated in the case of 10 TeV, with better statistical analysis of the signal significance and exclusion limit, and better understanding of the backgrounds. This work led to a CMS publication: « Search for high mass resonances decaying into in an electron pair in CMS at 10 TeV with 100 pb^{-1} », and its corresponding detailed CMS internal note. The analysis was presented to CMS for approval on July 1st 2009.

The IIHE members have been strongly involved in every step of the analysis, detailed here below.

- In order to select online high energy electrons, new trigger paths with different electron pt thresholds have been designed and tested.
- The selection was designed to have high efficiency (due to small expected number of signal events) while rejecting the QCD jet background, mainly thanks to electron identification and electron isolation criteria, in particular in the tracker. Improvement of the measurement of very high energy electrons by correcting for electronics saturation were studied and the same method is used to check the ECAL energy calibration at high energy. Sherif Elgammal was working in this subject and presented his

thesis in october 2009.

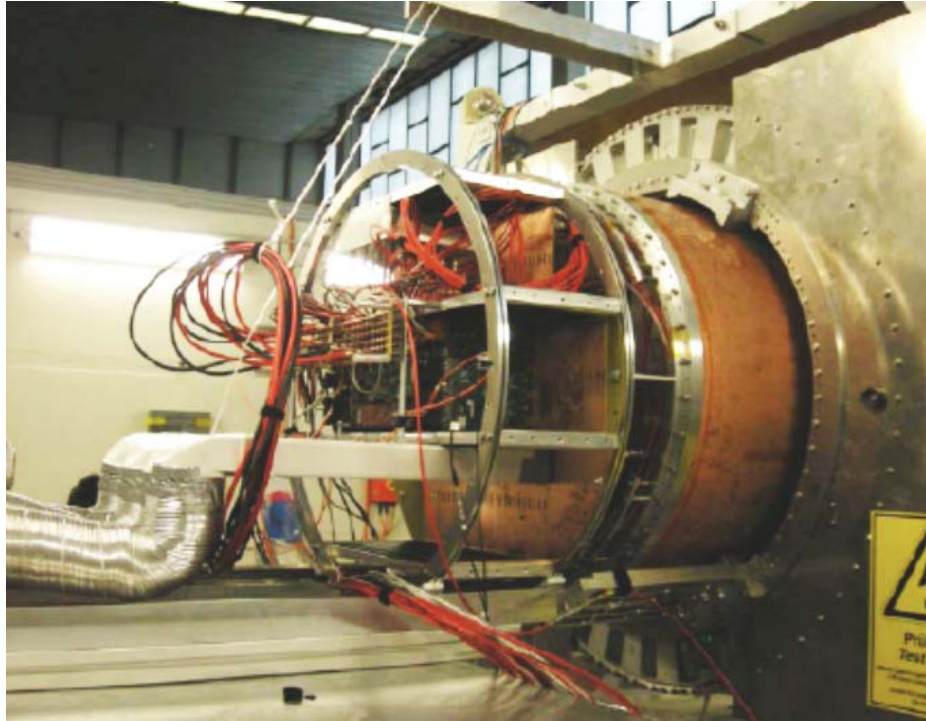
- An important work was to find procedures to estimate, from the data themselves, the selection efficiency and the remaining background in the final sample, in order to be as much as possible Monte-Carlo simulation independant. For this purpose, several complementary methods have been designed and tested on small statistic samples expected to be available at start up. The main background comes from top-antitop production and from the W+jet process where a jet is misidentified as an electron.
- Procedure to extract the the high mass ($M > 120 \text{ GeV}/c^2$) Drell-Yan cross section was established, with its expected statistical and systematical errors.
- Tools were developed to estimate the CMS five-sigma discovery potential for heavy resonances as well as the 95% confidence limit on the resonance production cross section in case of the absence of signal, and also statistical tools for the combination of the electron and the muon decay channel. The CMS reach has been scaled for center-of-mass energy of 7 and 6 TeV and a discovery is possible for several models of new resonance production in CMS already at LHC startup (year 2010/2011).

Finally the HEEP group in Brussels has participated to an exercise of the whole CMS collaboration to train the data flow, data transfer, data access, electron and photon trigger and event skimming. In addition, the rest of the analysis chain was also trained : electron identification, background measurement, signal extraction and was integrated into a unified analysis. The exercise used Monte Carlo production equivalent to 10 pb^{-1} of integrated luminosity, which includes the signal and all expected standard model processes.

IV. APPLIED R&D AND SPIN-OFF

IV.1 DATA ACQUISITION R&D PROJECT

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



TPC equipped with its front-end electronics and with its cooling system, partly inserted into the 1 Tesla supra-conducting magnet at DESY, Hamburg.

Since 2007, a small group of IIHE physicists has started R&D activities in the field of data acquisition (DAQ) systems for future experiments in particle and astro-particle physics. Modern technologies allow to design an DAQ architecture independent of the detector technology to which the DAQ system will be connected, providing freedom to the choice of this future experiment.

To conduct these developments in a concrete case, the laboratory started a collaboration with the University of Lund (Sweden) and CERN to develop the DAQ system for a large prototype of Time Projection Chamber (TPC) that could be installed at a future linear electron-positron collider (ILC or CLIC). This choice has been driven by the fact that the laboratory has a large expertise in the development of DAQ systems for the major experiments in (astro-) particle physics (DELPHI, H1, CMS, IceCube). In addition, the future linear collider projects plan to use the most advanced technologies from the telecommunication and the digital programmable electronic industries: the Advanced Telecom Computing Architecture (ATCA) standard and Field Programmable Gate Arrays (FPGA). These standards are also envisaged for the LHC upgrade, super-LHC. Consequently the experience that we are gaining by developing DAQ systems based on these standards will be a valuable asset for a probable participation of the IIHE in one of these future experiments.

The first DAQ prototype for the TPC has been developed and extensively used since end of 2008 with a large TPC prototype exposed to a 6 GeV electron beam at DESY (Hamburg). This DAQ system is based on the DAQ of the ALICE experiment at LHC but it had to be modified for the needs of the TPC. The modifications have been shared among the three institutes according to the expertise of each group. CERN developed a new front-end pre-amplifier and the University of Lund designed new front-end cards (FEC). The IIHE contributions in the project are numerous:

- development of a new electronic card equipped with FPGAs to distribute synchronization signals, to the FECs;
- programming of the FPGAs located on the FEC that control the front-end pre-amplifiers;
- in collaboration with the University of Lund and the University of Bonn, the development of the software to control and monitor the data acquisition.

These developments have been performed within the EUDET project supported by the European Union in the 6th Framework Program. EUDET has as objectives to create infrastructures to support the R&D programs for the future linear collider. In 2008, EUDET has identified the development of DAQ systems as a key component to setup these facilities, namely the design of a DAQ system common to various detectors that have to be tested together with beams.

At the end of the current test beam campaign with the large TPC prototype at DESY, end of 2010, the laboratory will improve the DAQ prototype, including components of the new ATCA standard to make it more flexible and easily adaptable to other detector technologies and other experiments. These developments will be performed in collaboration with the other sub-detectors (pixel detector, silicon strip detector and calorimeters) under study for an ILC experiment, in order to prepare common test beams which should take place within a couple of years. A first step has been made in November 2009, when the TPC has been tested in DESY with a couple of silicon strip sensors, using the card developed at the IIHE to synchronize both sub-detectors.

IV.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, E. Wieers, N. Pereira)



First patients test with the prototype dedicated PET scanner for mammography.

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 in using PET for mammography studies. Existing clinical PET systems are not optimized for this application, 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 for fundamental research in high energy physics, first using sodium iodide crystals, then using the improved performance from bismuth germinate (BGO), and more recently using superior

materials such as lutetium orthosilicate or lutetium aluminates. These new scintillators are faster and produce more light 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 : the ClearPET. The design of these small animal PET scanners is based on the use of position sensitive PMTs (PSPMT) and a phoswich of LSO/LuYAP 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 three 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 to also include effects such as dead time, event buffering, energy threshold blurring, data transfer rates, ...etc.

A second ClearPET system is now installed in the IIHE. This system has 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 scanners, 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 solid scintillator blocks to eliminate dead zones in- between the crystals. In addition, these scintillator blocks are less expensive 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 the modules 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 shows 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 Jülich (FZJ, Germany). The basic detector modules will consist of a dual layer of trapezoidal LSO blocks. The complete system will consist of 4 detector rings, each with 52 detector modules. To determine the optimal design parameters of the detector modules, extensive simulations using GATE, were performed. This allowed us to estimate 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, ...etc. The final parameters of the BrainPET system that will be developed by the collaboration were determined on the basis of this study.

One of the conclusions of our study was that the 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 newly developed silicon PMTs allow a much larger gain and therefore could significantly improve the resolution that can be achieved with such a system.

Our research group is also involved in the development of a second generation of the ClearPET 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 algorithms, a suitable phantom has to be developed that can be used for both the PET and US imaging modelityt. 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.

researcher passed the IIHE in 2009 and is supporting the distributed simulation software and will oversee the Brussels simulation production.

B. LOCAL CLUSTERS

The local computing facility consists of:

- A cluster composed of 180 cores for a total processing power of more than 200 GFLOPS and a 300 GB total RAM. This cluster is running Condor as resource manager and scheduler. It is used by the AMANDA/IceCube and PET physicists for their analysis.
- A cluster server consisting of 8 cores, 16 GB of RAM and 1 TB of hard disk space is providing the management of the cluster. It has a 4 Gbps connection to Ethernet.

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);
- A new Sun Microsystems x4500 storage system with a raw capacity of 36 TB connected to Ethernet through a 4 Gbps line.

The IceCube group at the end of 2009 contributed additional cluster hardware:

- A 96 TB (75 TB usable) disk storage array (SunFire X4540 server + J4500 storage array)
- 5 SunFire X2200 8-core AMD Opteron servers, each with 32 GB physical RAM to accommodate the specialized needs of the IceCube simulation software.

These resources are being integrated into the existing 180-core cluster. In the near future we expect to further increase the computing and storage resources with additional purchases from the IceCube group. The IceCube collaboration depends on member institutions to contribute CPU and storage resources to assist in the production of the IceCube Monte Carlo simulation. The IIHE will contribute at least 100 cores for this purpose.

C. LARGE-SCALE COMPUTING

Distributed computing based on Grid technology is the solution chosen by CERN for the storage and the analysis of the enormous data that is produced by the LHC experiments. The IIHE computing team is involved in several national and international Grid projects. In addition, members of the IIHE act as representatives of the ULB and the VUB in regional bodies promoting the deployment of large computing infrastructures in Belgium, the Consortium des Equipements de Calcul Intensif (CECI) in the French Community and the Vlaams Supercomputing Center (VSC) in Flanders.

CMS TIER-2

In 2009 the IIHE further deployed the "Tier-2" cluster integrated in the hierarchy of computing centers that process the data of the CMS experiment. The IIHE cluster was officially inaugurated on May 6, 2009, in the presence of the academic authorities of the ULB and VUB and of the Secretary General of the FRS-FNRS, Mme Véronique Halloin.

The IIHE Tier-2 is installed in the infrastructures of the ULB-VUB Computing Center and hosts the contributions of the UA, UGent, UMH, ULB and VUB funded by the F.R.S.-FNRS and by the FWO-

Vlaanderen. At the end of 2009, the cluster comprised 446 processing cores in 52 physical nodes for an equivalent of 4.5 teraflops of processing power, 480 batch job slots, and 270 terabytes of disk space. It is connected to the Belgian research network BELNET through a reliable, large-bandwidth connection (1.5 Gb/s). It is supporting the analyses of the Belgian CMS physicists, ~65 people from both French-speaking and Flemish universities, in collaboration with the UCL Tier-2 site. The contributions of the IIHE Tier-2 to the Worldwide Grid computing power and to the amount of analysis jobs ran by physicists of the CMS collaboration is significant, as illustrated in Figure XX.

Three IT scientists (Shkelzen Rugovac, Olivier Devroede and Stéphane Gérard) are currently in charge of the Tier-2 deployment and support. The physicist in charge of the Belgian Tier-2 sites, and representative to the W-LCG and CMS computing boards, is Pascal Vanlaer, seconded by Giacomo Bruno (UCL). O. Devroede is the technical coordinator of the Belgian Tier-2 sites. An informal Belgian user committee has been set up, with one representative per university participating, which is consulted at regular intervals.

Since December 2009 the IIHE Tier-2 is hosting several reprocessed versions of the data of the first LHC collisions at 900 GeV and 2.36 TeV center-of-mass energy, and the corresponding Monte Carlo samples. These data are actively analyzed by CMS physicists from Belgium and from the whole CMS collaboration. The IIHE Tier-2 also hosts samples for the Top and JetMET physics analysis groups for a total of 100 TB of reserved disk space. Finally, one third (90 TB) of the disk space is reserved for the analyses performed in Belgium.

The IIHE took new responsibilities in the management of the computing of the CMS experiment, as a significant part of the service activity requested by the CMS collaboration:

- Jorgen D'Hondt is the liaison person between the CMS physics coordination group and the computing management;
- members of the IIHE are responsible for the deployment of new CMSSW releases on the Tier-2 sites of Europe and Asia;
- members of the IIHE are in charge of the production on the Grid of 1/10 of the Monte-Carlo simulated samples for the collaboration;
- the Tier-2 technical team took in charge the testing of new releases of the CMS Remote Analysis Builder software CRAB;
- members of the IIHE are in charge of automatizing the selection of reliable sites into CRAB.

BEGRID

The IIHE is actively participating in the Belgian grid project BEgrid, initiated in 2003 by Rosette Vandenbroucke via the Belgian National Research Network provider BELNET. A cluster of about 200 processors is administrated together with the CMS Tier-2 and made available to BEgrid users. BEgrid is now recognised as the Belgian National Grid Initiative (NGI) by an official committee of the Science Policy department of the federal Government in which all regions and funding agencies are represented. In this function BEgrid has become member of EGI, the European Grid Initiative, which is the federation of national grid platforms at the European level.

In addition to supporting CMS analyses, the IIHE team offers support for BEgrid users from ULB and VUB and is involved into various international projects:

- The EGEE (Enabling Grids for EScience) FP6 project of the European Commission
- The collaboration with Moroccan scientists to promote grid technologies in this country
- The involvement in EumedGrid activities through the collaboration with Morocco. EumedGrid is a EU initiative to build a pilot grid platform for research across the Mediterranean, compatible with the EGEE infrastructure

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

The IIHE (ULB-VUB) is part of the IAP 6/11 "Fundamental Interactions: at the boundary of theory, phenomenology and experiment" (www.f-i.be) from 2007 until 2011. The members of the network are: Theoretische Fysica (KUL), Elementaire Deeltjes Fysica (UA), Centre de Physique des Particules et de Phénoménologie (CP3-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 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. We had in 2009 two general meetings where the activities of all the teams were presented. One of these meetings was co-organised by the VUB group of the IIHE (20/10/2009). Moreover, the physicists of the IIHE participated actively to common seminars and journal clubs. They also contributed to the working group dedicated to the elaboration of future experiments to which the members of the network could participate during the second half of this decade.

VII. TECHNICAL AND ADMINISTRATIVE WORK

The members of the workshop staff in 2009 were: J. De Bruyne, P. de Harenne, L. Etienne, R. Goorens, S. Hannaert, G. Van Beek, R. Vanderhaeghen, L. Van Lancker, Ch. Wastiels and Yang Yifan. 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. He is also responsible of the future RPC assembly project in Belgium. P. de Harenne and S. Hannaert participated to the final assembly 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.

Yang Yifan is responsible for the development of a test DAQ system for a new TPC in the framework of the preparation of new detectors for future experiments. 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. He also participated to the design of a new didactic experiment to measure the angular distribution of cosmic rays as well as Cherenkov rings with the help of a multi anode photomultiplier.

L. Etienne is in charge of the maintenance of a data acquisition system for a cosmic ray experiment to be implemented in secondary schools (OCRE-KOSMIS).

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 D. Peymans and M. Goeman. They were working in collaboration with A. De Coster, F. Pero and D. Pirnay. D. Peymans took part in the organisation of the ULB master classes. A. De Coster was responsible of the library of the Institute. She also maintains the database of the physicists publications. F. Pero is more particularly in charge of the organisation of the travels of the members of the IIHE. M. Goeman was in charge of the logistic support of the CRYSTAL CLEAR project. She also took part in the organisation of the symposium in honour of S. Tavernier and of the IAP meeting at the VUB. D. Pirnay maintained the IAP website and implemented the GOA website. D. Pirnay was in charge of the logistic support of the 8th Quattor Workshop. She also took part in collaboration with A. De Coster in the organisation of the inauguration of the cluster CMS TIER-2.

VIII. SYMPOSIUM IN HONOUR OF STEFAAN TAVERNIER



On October 15th the IIHE and the Crystal Clear Collaboration organised a symposium in honour of the retirement of Stefaan Tavernier. The organising committee consisted of Daniel Bertrand (IIHE), Catherine De Clercq (IIHE, chair), Karl Ziemons (Crystal Clear Collaboration) and Marleen Goeman (IIHE, secretary).

The programme of the symposium was the following:

13:30	Coffee	
14:00	Welcome	Catherine De Clercq, IIHE
14:15	Highlights of Stefaan's scientific career	Paul Lecoq, CERN
15:00	Coffee	
15:15	Inorganic scintillators, R&D in three centuries	Carel van Eijk, TU Delft
16:00	Positron Emission Tomography (PET) as a leading technology transfer project from High Energy Physics to Medical Physics	Karl Ziemons, FZC Jülich
16:45	Stefaan's academic career	Patrick De Baetselier, VUB
17:00	Closing remarks	Catherine De Clercq, IIHE
17:05	Reception in the <u>STOA, VUB</u> , offered by the IIHE.	
19:30	Dinner in " <u>Les Foudres</u> "; €50; Eugène Cattoirstraat, 14, 1050 Elsene (10 min. walk from the VUB)	

IX. REPRESENTATION IN ACADEMIC COUNCILS AND COMMITTEES

Daniel Bertrand

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

Catherine De Clercq

- Secretary Examencommissie Bachelor Fysica
- President Examencommissie Master Fysica VUB

Olivier Devroede

- Member PR "Commissie Wetenschappen"
- Member Vakgroepraad Fysica.

Pierre Marage

- Vice-president Centre de Culture scientifique de l'ULB à Charleroi - Parentville
- Membre du CA Altair, asbl d'Histoire des Sciences attachée à l'ULB
- Directeur de section Institut des Hautes Etudes de Belgique
- Member of the "Conseil d' Institut national des Radioéléments, Fleurus"

Stefaan Tavernier

- Member of the "Bevorderingscommissie ZAP"

X. REPRESENTATION IN SCIENTIFIC COUNCILS AND COMMITTEES

Daniel Bertrand

- Member representative of the FNRS Aspera Steering Committee
- Member representative of the FNRS ApPEC Steering Committee
- Member of the C4 commission on Cosmic Rays of the International Union of Pure and Applied Physics (IUPAP)
- Member IIHE CERN fellows Belgian selection committee
- Member IIHE PAI governing board
- Member Belgium Astroparticle group of the OECD Global Science Forum
- Member Belgium SAC (Science Advisory Committee) of the Aspera Era-Net

Catherine De Clercq

- Member FWO commissie E5 Subatomaire Fysica
- Member IISN commission des Hautes et Basses Energies
- Member NIKHEF Scientific Advisory Committee
- Vice-president board of the IAP 6/11 Fundamental Interactions
- Representative of FWO in ASPERA Eranet Governing Board
- Member organisation committee of the Belgian-Dutch-German summer school
- Representative of Belgium in Plenary ECFA
- Representative of the FWO in ApPEC steering committee
- Representative of VUB in Vlaamse Raad voor Wetenschapsbeleid- CFIS"

Gilles De Lentdecker

- Member ULB representative Belgian Physical Society

Olivier Devroede

- Member VSC technische werkgroep

Laurent Favart

- Member H1 executive committee

Pierre Marage

- Membre titulaire Comité national de Logique, de Philosophie et d
- Member FWO - Commissie E5 (Subatomaire Fysica)
- Member SPSC - CERN
- Co-organiser Ecole d'été Penser l'évolution, Penser la science, ULB

Pascal Vanlaer

- Member Representative of the Belgian Tier-2 computing center CMS Computing Resource Board
- Member ULB representative groupe de contact FRS-FNSR du Consortium des Equipements de Calcul Intensif
- Member Analysis Review Committees (ARC) of the CMS collaboration

Walter Van Doninck

- Member EPS HEPP Board
- Belgian Scientific Delegate CERN Council

XI. TEACHING ACTIVITIES - ACADEMIC YEAR 2008-2009

Daniel Bertrand

- PHYS 105 "Stage de laboratoire" (0/0/75/0) 1ere licence en sciences physiques Full time
- PHYS 105 "Stage de laboratoire" (0/0/75/0) Master 1 en sciences physiques Full time

Peter Bruyndonckx

- WE-DNTK-2118 "Medische Fysica" (13/13/0/0) 3BA Fysica VUB Full time

Barbara Clerbaux

- PHYS F416 "Interactions fondamentales et particules" (18/0/0/0) MA1 Full time
- WE-DNTK-9246

Catherine De Clercq

- "Meten en Experimenteren" (responsable - 0/0/65) 1 BA Fysica VUB Full time,
- WE-DNTK-1998 "Elementaire Deeltjesfysica I" (26/0/26/0) 3 BA Fysica VUB Full time,
- WE-DNTK-12521 "Astroparticle physics" (13/13/0/0) Master fysica VUB Full time,

Gilles De Lentdecker

- PHYS-F-305 "Laboratoire de physique des particules" (0/0/0/32) BA3 Full time
- PHYS-F-205 "Physique 2" (0/0/24/24) BA2 Full time

Olivier Devroede

- "Informatica (modula 2)" (26) 1 BA Full time
- "Computervaardigheden" (60) 1 MA Full time

Eddy De Wolf

- 2BFYS-07 Kanstheorie en statistiek (30/30) BA2 Full time
- MFYS1009 Theorie van de Fundamentele Wisselwerkingen (30/30) MA1 Full time
- MFYS1011 Experimenteel Labo (0/30) MA1 Full time
- MFYS1012 Capita Selecta / Studentenseminarie (30/0) MA1 Full time

Joris Maes

- WE-DNTK-9246 "Meten en experimenteren" (0/0/40/40) 1BA Full time
- WE-DNTK-11357 "Statistische verwerking van experimentele gegevens" (0/0/13/13) 2BA Full time

Pierre Marage

- HIST-F-101 "Histoire des Sciences" (24/0/0/0) BA1 Full time
- PHYS-F-104 "Physique generale" (48/0/0/20) BA1 Full time
- HIST-F-500 "Histoire des Sciences et Epistémologie" (24/0/0/0) MA-didact., AESS Full time
- PHYS-F-436 "Stage de physique expérimentale des particules" (0/0/64/0) MA-1 Full time
- COMM-B-413 "Questions d'actualité des sciences (MA-1 Journalisme et communication)" (8/0/0/8) MA-1 Part time
- PHYS-F-500 "Histoire des sciences physiques et mathématiques" (24) MA-2 Full time

Benoit Roland

- Introduction to ROOT(4/2) 2008 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) 3BA Full time
- IR--12405 "Measurement techniques in nuclear and particle physics" (16/0/16/0) MA1 Biomedical engineering (UGent-VUB) Full time

Walter Van Doninck

- ELEM II "The Standard Model" (15 hours) 2008 Part time

Pascal Vanlaer

- PHYS-J-101 "Physique Generale" (0/36/0/0) BA1 Full time
- PHYS-F-301 "Techniques de la Physique Expérimentale" (24/0/36/0) BA3 Full time
- PHYS-F-205 "Physique Générale" (0/0/36/0) BA2 Full time
- PHYS-F-104 "Physique Générale" (0/48/0/0) BA1 Full time
- PHYS-H-303 "Projets de bibliographie de 3e année Ingenieur civil physicien" (0/0/0/12) BA3 Full time

Pierre Van Mechelen

- 2BFYS-02 Algemene fysica IV : Relativiteitstheorie, elementaire deeltjesfysica (30/30) BA2 Full time
- 3BWIS-K-11 Elementaire deeltjesfysica (15/15) BA3 Full time
- GLNATU01A10141 Subatomaire fysica (20/10) BA3 Full time
- MFYS2024 Versnellerfysica (15/15) MA2 Full time

Petra Van Mulders

- WE-DNTK-9246 "Meten en experimenteren" (0/0/40/40) 1BA Full time
- WE-DNTK-12058 "Statistiek voor fysici" (0/13/0/30) 1BA Full time

Nick Van Remortel

- 2BFYS-08 Informatica II (20/35) BA2 Full time
- 2BFYS-11 Elektronica (15/15) BA2 Full time
- MFYS20041 Project computer-simulatietechnieken (0/45) MA Full time
- MFYS2012 Computergestuurde Experimenten en Data Acquisitie (10/20) MA Full time

Pierre Vilain

- PHYS-F-305 "Physique des particules élémentaires" (24/0/0/12) BA3 Full time

Mateusz Wedrowski

- "Kernfysica en toepassingen" (0/13/0/0) 3BA Phys Full time
- "Nucleaire meettechniek" (0/13/0/0) 1MA Biomedical Engineering, MA1 UA Full time

XII. MASTER AND PHD THESES COMPLETED IN 2009

XII.1 MASTER THESES

Stijn Blyweert

- "Top quark physics with b-jets containing muons with CMS" 17/06/2009 Promotor: Jorgen D'Hondt

Michael Maes

- "Usage of the ParticleFlow method at the CMS detector." 17/6/2009 Promotor: Jorgen D'Hondt

XII.2 PHD THESES

Marco Cardaci

- "ADD extra dimensions searches with monojet events and resonance searches with dijet events with the CMS detector", 21/12/2009, UA, Promotor Pierre Van Mechelen

Mathieu Labare

- "Search for cosmic sources of high energy neutrinos with the AMANDA-II detector" 26/01/2010 Promotor: Daniel Bertrand

Sherif Elgammal

- "Detection of high energy electrons in the CMS detector at the LHC" 10/11/2009 Promotor: Barbara Clerbaux, Pierre Marage

Deniz Sunar

- "Measurement of $K^*(892)$ production in deep inelastic scattering with the H1 detector at HERA", 13/07/2009, UA, Eddi De Wolf

XIII. SEMINARS AND ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS AND COLLABORATION MEETINGS

XIII.1 SEMINARS AT THE IIHE (ORGANISED BY L. FAVART)

-
-

XIII.2 SEMINARS

Volker Adler

- (CERN, Geneva, Switzerland): "Trigger Information in the PAT" 03/12/2009
- (CERN, Geneva, Switzerland): "MC and Trigger Matching" 03/02/2009
- (CERN, Geneva, Switzerland): "MC and Trigger Information in the PAT v2" 17/06/2009
- (DESY, Hamburg, Germany): "Trigger analysis at CMS" 02/07/2009
- (CERN, Geneva, Switzerland): "MC and Trigger Information in the PAT" 04/09/2009

Marco Cardaci

- "Extra-Dimensions and other Exotic searches with Dijet and Monojet events with the CMS detector", University of Strasbourg, Strasbourg, France - 22 September, 2009

Xavier Janssen

- "IIHE DAQ activities for future experiments" IIHE (ULB-VUB) General Meeting, 19th June, 2009

Pierre Marage

- (Formation sur la neutralité, AESS, ULB):"Rapports entre sciences et religions" 02/2009
- (Egyptian School on High Energy Physics, British University of Egypt à Cairo - Egypt):"Phenomenology at colliders (3 lectures)" 01/06/2009.

Walter Van Doninck

- (Zurich Swiss Group of International Schools):"Big Bang cosmology and its connection to Particle Physics" 6/3/2009
- (Zurich Swiss Group of International Schools):"Capita selecta from experimental Particle Physics" 6/3/2009

Pascal Vanlaer

- (Isfahan, Iran):"Electron and photon reconstruction in CMS (on behalf of the CMS collaboration)" 23/04/2009

XIII.3 ORAL PRESENTATIONS AT CONFERENCES, SCHOOLS

Marco Cardaci

- " Extra Dimensions in Photon or Jet plus Missing Transverse Energy", talk given at SUSY09, 17th International Conference on Supersymmetry and the Unification of Fundamental Interactions, Boston, Massachusetts, United States 5-10/6/2009

Gilles De Lentdecker

- "A Large TPC Prototype (LPTPC) for an ILC Detector" - Orlando, USA 29/10/2009

Julie Delvax

- "Study of Diffractive Interactions with jet production at HERA" - BPS-BBS U.Hasselt 01/04/2009 – No proceedings

Laurent Favart

- "Inclusive diffraction and a measurement of the diffractive longitudinal structure function FLD at HERA" - EPS HEP-09 – Krakow, Poland - 18/07/2009
- "Vector Meson production and DVCS at H1 (HERA)" - First European Workshop of CLAS12 – Genes, Italy - 27/02/2009

Majid Hashemi

- " Standard Model Higgs at the LHC', XXXIX International Symposium on Multiparticle Dynamics - Gomel, Belarus - 4-9 September 2009
- Higgs Search in $H \bullet WW(\bullet)$ Channel with the CMS Detector", XXth Hadron Collider Physics Symposium - Evian, France - 16-20/11/2009

Tomas Hreus

- "Diffractive production of photons at high t " - XVII International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2009), Madrid, Spain - 28/04/2009

Xavier Janssen

- Exclusive diffraction at HERA" - LISHEP 2009 (International School on High Energy Physics) - Rio de Janeiro, Brazil - 19-23/1/2009
- "The Linear Collider Large Prototype Time Projection Chamber DAQ", IEEE NPSS Real Time Conference - Beijing, China - 10-15/5/2009
- "Diffractive electroproduction of rho and phi mesons at HERA", EPS 2009 , Europhysics Conference on High Energy Physics - Krakow, Poland - 16-22/7/2009
- "Exclusive Diffraction at HERA"ISMD2009, XXXIX International Symposium on Multiparticle Dynamics - "Golden Sands" ,Gomel Region, Belarus 4-9/9/2009

Pierre Marage

- "Exclusive Hard Diffraction at HERA (DVCS and Vector Mesons) " - EDS09- CERN – Geneva, Switzerland - 30/06/2009
- "DVCS and Vector Meson production with H1 (Soft and hard diffraction, spin dynamics and QCD)" - DIS2009 – Madrid, Spain - 21/04/2009

Luca Mucibello

- "Unfolding Underlying Event in charged jets", Multi Parton Interaction Workshop, giving a presentation - Geneve - 5-7/11/2009

Silvia Ochesanu

- "Mini experimental review of low-x at LHC" - Oral Presentation 2009 Europhysics Conference on High Energy Physics - Krakow, Poland

Benoit Roland

- "Forward physics capabilities of CMS with the CASTOR and ZDC detectors", Workshops on Deep-Inelastic Scattering and Related Subjects (DIS09) - Madrid, Spain - 26-30/4/2009

Romain Rougny

- "Performance of CMS with first data", SLHC-PP-2010 conference - Madrid , Spain , 05/02/2010

Michele Selvaggi

- "Higgs Search in $H \rightarrow WW()$ Channel with the CMS Detector", BND Summer School Rathen 2009

Walter Van Doninck

- "Le LHC: Pont entre deux infinis " - Colloque multidisciplinaire "Franchir les murs " Jeter des ponts" , Namur, Belgium - 9/11/2009

Pascal Vanlaer

- "Prospects for Observation of Dark Matter and Extra Dimensions in CMS (on behalf of the CMS collaboration)" Very High Energy Phenomena in the Universe – Moriond, La Thuile, France - 5/02/2009

Pierre Van Mechelen

- "Large Hadron Collider - Present status and future prospects", BPS - General Scientific Meeting - Hasselt, Belgium 1/4/2009

Petra Van Mulders

- "JobMon tool " - ASTF meeting, CERN, Geneva, Switzerland - 21/01/2009
- "CMSSW deployment status" - Facilities Operations Meetings, CERN, Geneva, Switzerland - 14/12/2009
- "Estimating jet energy scales from top events" - CERN, Geneva, Switzerland - 07/07/2009

Nick Van Remortel

- Minimum bias and underlying event studies at CMS, XVII International Workshop on Deep-Inelastic Scattering and Related Topics - Madrid, Spain - 26-30/4/2009

XIII.4 POSTER PRESENTATIONS AT CONFERENCES, WORKSHOPS AND SCHOOLS

Volker Adler

- "Data Quality Monitoring of the CMS Tracker" - Orlando, FL, USA - 27/10/2009

Wim Beaumont

- "Design of the CMS-CASTOR subdetector readout system by reusing existing designs" Workshop, TWEPP09 - Paris, France - 21-26/9/2009

Leonardo Benucci

- "Data Quality Monitoring of the CMS Silicon Strip Tracker detector", FDFP09: Frontier Detectors for Frontier Physics - 11th Pisa Meeting on Advanced Detectors - Isola d'Elba, Italy - 5/2009
- "Search for Mono-Jet Final States at 10 TeV", HCP2009: XXth Hadron Collider Physics Symposium - Évian-les-Bains, France - 11/2009
- "Data Quality Monitoring of the CMS Silicon Strip Tracker Detector", 17th International Conference on Computing in High Energy and Nuclear Physics - Prague, Czech Republic - 21-27/3/2009
- "Search for Extra dimensions in a single-jet and missing energy channel at CMS experiment", "XXth Hadron Collider Physics Symposium" - Evian - 16-20/11/2009

Marco Cardaci

- "Extra Dimensions in Photon or Jet plus Missing Transverse Energy signatures", poster presented at EPS HEP 2009, The 2009 Europhysics Conference on High Energy Physics - Krakow, Poland - 16-22/7/009

Yves Pierseaux

- "From the Lorentz Transformation to the Hubble Law" - revue IIHE, février 2010 31/12/2009
- "From Special Relativity with Finite Interval to Steady State theory with Cosmological Constant" - revue IIHE, février 2010 31/12/2009.

XIII.5 PRESENTATIONS AT COLLABORATION MEETINGS

Volker Adler

- "SiStrip Data Certification - A Possible Sub-Detector Schema" - CERN, Geneva, Switzerland - 17/03/2009

Stéphanie Beauceron

- "Alignment & Calibration Triggers" - CERN, Geneva, Switzerland - 26/06/2009
- "Alignment & Calibration Triggers" - CERN, Geneva, Switzerland - 11/12/2009

Stijn Blyweert

- "Using a simple muon-b-tagger to select top events" - Top Quark Meeting, CMS Collaboration, CERN, Geneva, Switzerland - 07/07/2009
- "Comparison of Cosmics Reconstruction (2_2_13 vs 3_1_1 vs 3_2_4)" - PVT Meeting, CMS Collaboration, CERN, Geneva, Switzerland - 19/08/2009

Marco Cardaci

- "Extra-Dimensions and other Exotic searches with Dijet and Monojet events with the CMS detector", talk to be given at IAP Meeting, - Brussels, Belgium, - 2/10/2009

Eric Chabert

- "Jet combinatorics in mu+jets" – CERN, Geneva, Switzerland - 18/03/2009
- "Predicting ttbar background using b-tags" - CERN, Geneva, Switzerland - 02/07/2009
- "An example of a local validation strategy" - CERN, Geneva, Switzerland - 23/06/2009
- "WG IV: Top Montecarlo Validation Framework" - CERN, Geneva, Switzerland - 10/07/2009
- "Data Quality Monitoring - Monte Carlo validation in Top PAG" - CERN, Geneva, Switzerland - 01/09/2009
- "Status Report on Strip Tracker FU Local Reconstruction DQM" - CERN, Geneva, Switzerland - 02/10/2009
- "Status of muon HLT monitoring" - CERN, Geneva, Switzerland - 08/10/2009
- "HLT monitoring" - CERN, Geneva, Switzerland - 05/11/2009
- "Update on QCD, W+jets & ttbar studies for MET" - CERN, Geneva, Switzerland - 09/12/2009

Barbara Clerbaux

- "Diffractive Search for high mass resonances decaying into an electron pair in CMS at 10 TeV with 100 pb„1" - CMS physics plenary meeting, CERN, Geneva 01/07/2009

Julie Delvax

- "Diffractive Dijets production using VFPS (status report)" - DESY, Hamburg, Germany - 14/05/2009

Tomas Hreus

- "VFPS: F2D(3)" - H1 Collaboration Meeting, Prague, Czech Republic - 15/09/2009

Mathieu Labare

- "FDR method applied to AMANDA data 2000-2006" - Madison, WI, USA - 29/04/2009

Joris Maes

- "Use of DashBoard for monitoring (data format, analysis, ...)" - Geneva, Switzerland - 21/01/2009
- "Data driven method to estimate b-tag efficiencies from top events" - Geneva, Switzerland - 07/07/2009
- "DashBoard for Analysis Monitoring" - Geneva, Switzerland - 04/02/2009
- "DashBoard for Analysis Monitoring" - Geneva, Switzerland - 11/02/2009
- "DashBoard analyses" - Geneva, Switzerland - 25/02/2009
- "DashBoard analyses" - Geneva, Switzerland - 04/03/2009
- "Data driven method to estimate b-tag efficiencies from top events" - Geneva, Switzerland - 13/07/09

Michael Maes

- "Differences between Calo jets and Particle Flow jets for top physics" - Top Quark Meeting 07/07/2009
- "Differences between Calo jets and Particle Flow jets for top physics" - Particle Flow Working Meeting 10/07/2009
- "Calo jets versus Particle Flow jets for top physics" - Boosted Top Meeting 17/7/2009
- "Comparison of 229 vs 331 reprocessings" - PVT meeting 05/08/2009
- "Reports on CRAFT09 data (re)processings: Comparing cosmics reprocessing" - PVT meeting 28/10/2009
- "Muon Isolation in Cosmic events" - Cosmic Muon Analysis meeting 3/12/2009

Benoit Roland

- "Forward Physics Capabilities of CMS with the CASTOR calorimeter", Interuniversity Attraction Poles (IAP) meeting - VUB, Brussels, Belgium – 2/10/2009

Romain Rougny

- "CRAFT Final Results for the CMS pixel detector" during the tracker week - CERN, Geneva, Switzerland - 21/04/09

Ilaria Villella

- "Technologies for survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 21/01/2009
- "CRAB User Survey, Third Draft, Plans" - Analysis Support Task Force, CERN, Geneva, Switzerland - 04/02/2009
- "CRAB User Survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 11/02/2009
- "CRAB User Survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 18/02/2009
- "CRAB User Survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 25/02/2009
- "CRAB User Survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 04/03/2009
- "CRAB User Survey" - Analysis Support Task Force, CERN, Geneva, Switzerland - 11/03/2009
- "ASTF Survey" - PADA meeting, CERN, Geneva, Switzerland - 05/02/2009

XIV. SCIENTIFIC VULGARISATION AND OUTREACH ACTIVITIES

Stéphanie Beauceron

- "Main guide for many visits to CMS experiment" - CMS visits 2009

Daniel Bertrand

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

Catherine De Clercq

- "IceCube: neutrino's vangen op Antarctica" - workshop, Herfstkamp Wetenschappen - 06/11/2009
- "IceCube: neutrino astronomie op de Zuidpool" - oral presentation, Wetenschapscaravaan UPV-VUB - 20/04/2009
- "Member of the Flemish Physics Olympiads Committee" - Physics Olympiads since 2005
- Visit of CERN for VUB students - 13/02/2009
- "Execution of practical 'luchtkussenbaan'" - laboratory visit for high school students - 04/03/2009
- "Execution of practical 'akoestiek'" - laboratory visit for high school students - 04/03/2009

Gilles De Lentdecker????

- "Organizer" - Master Classes 14/03/2009"
- "Organizer" - Master Classes 31/01/2009"

Tomas Hreus

- "PC exercises supervision" - Master Class - 31/01/2009

Joris Maes

- "Present, as a citizen of Belgium, at the visit of King Albert II to the CMS experiment" - Visit of King Albert II at the CMS experiment - 19/02/2009

Pierre Marage

- "Charles Darwin et Georges Lemaître, une improbable mais passionnante rencontre" - Compte-rendu du livre de D. Lambert et J. Reisse, Espace de Libertés 372 - 02/2009
- "Conference, Club Sholem Aleichem" - Galilée, le procès d'un procès - 07/05/2009
- "Les combats de Galilée" - Article publié dans 'L'Artichaut', revue du CEPULB -10/2009, pp. 20-27 10/2009
- "Les combats de Galilée" - Conférence CEPULB, ULB - 12/10/2009
- "La naissance de la physique moderne, racontée au fil des Conseils Solvay" - Présentation de l'ouvrage, Librairie Tropismes, Bruxelles - 17/11/2009

- "La naissance de la physique moderne, racontée au fil des Conseils Solvay" - Interview radio, émission Â« Semence de curieux Â» (J. Olivier), 3 émissions 28/11, 5 & 12/12/20
- "Les sciences arabes au Moyen-Age" - Conférence Club Sholem Aleichem, Bruxelles 10/12/2009
- "P. Marage et G. Wallenborn, La naissance de la physique moderne, racontée au fil des Conseils Solvay" - Réédition aux Editions de l'ULB, collection UBLivre, 2009

Pascal Vanlaer

- "Le LHC et la Grille de calcul" - radio Campus science programme - 20/05/2009
- "Inauguration of Brussels Tier-2 computing center" - Inauguration - 06/05/2009
- "1e Journée de contact du Consortium des Equipements de Calcul Intensif FRS-FNRS" - Conference - 06/05/2009

Walter Van Doninck

- "Guide" - CMS visits many

Pierre Van Mechelen

- "De deeltjesversneller uitgelegd", discussie-avond met Prof. Veltman, deBuren - Brussels, Belgium – 22/1/2009
- "Stokbrood uit de toekomst", Knack, 30/12/2009
- "Start to Know: Kosmologie", addendum to EOS, 1/2009
- "Start to Know: Kosmologie", weblog <http://starttoknow.scilogs.be/index.php?blogId=3>

Petra Van Mulders

- "Present as a Belgian citizen for the visit of King Albert II" - Visit of King Albert II at the CMS experiment - 19/02/2009

Nick Van Remortel

- "Zoektocht naar de Heilige graal van de fysica: het Higgs Boson", Inaugurele Les - Universiteit Antwerpen, Antwerp, Belgium - 4/12/2009
- "Voorstelling Nationaal Biografisch Woordenboek", Koninklijke Academie van België voor Wetenschappen en Kunsten – Brussels, Belgium – 25/11/2009
- Avondlezing Jong KVCV - Diepenbeek, Belgium - 12/11/2009
- "Elementaire deeltjesfysica: Een reductionistische zoektocht naar de schepping", Studium Generale Lezingencyclus 2009-2010, 9/11/2009
- "Oerknallers", Kinderuniversiteit, 8/3/2009
- "Ach (Velt)man!", Bijdrage aan Scientific American (Nederlandse ed.), maartnummer (nr 2) 2009

XV. ATTENDANCE TO CONFERENCES, WORKSHOPS AND SCHOOLS

XV.1 CONFERENCES AND WORKSHOPS

Volker Adler

- "CMS collaboration meeting", CERN, Geneva, Switzerland Oral presentation - 16-20/03/2009
- "CMS physics week", Bologna, Italy 07-11/09/2009
- "IEEE Nuclear Science Symposium", Orlando, FL, USA Poster - 25-31/10/2009
- "CMS collaboration meeting", CERN, Geneva, Switzerland - 06-12/12/2009

Stéphanie Beauceron

- "IAP", Brussel Oral presentation - 02/10/2009

Leonardo Benucci

- "CMS Physics Week 2009, Frontier Physics at the LHC - Bologna, Italy, 7- 11/9/2009

Daniel Bertrand

- "XIII International Workshop on Neutrino Telescopes", Venice, Italy - 10-13/03/2009

Stijn Blyweert

- "CMS Week", CERN, Geneva, Switzerland - 07-11/12/2009

Marco Cardaci

- "CMS Physics Week 2009, Frontier Physics at the LHC - Bologna, Italy 7- 11/9/2009
- "IAP Meeting" - Brussels, Belgium - 2/10/2009
- "LP09, XXIV International Symposium on Lepton Photon Interactions at High Energies" - Hamburg, Germany - 17-22/8/2009
- "EPS HEP 2009, The 2009 Europhysics Conference on High Energy Physics" - Krakow, Poland -16-22/7/2009
- "SUSY09, 17th International Conference on Supersymmetry and the Unification of Fundamental Interaction" - Boston, Massachusetts, United States - 5-10/6/2009
- "BPS General Scientific Meeting 2009" - Hasselt, Belgium - 1/4/2009

Eric Chabert

- "Top quark physics: from the Tevatron to the LHC", CERN 18/05-05/06/2009

Barbara Clerbaux

- " Aspen Winter 2009 - Workshop on Physics at the LHC era", Aspen, Colorado, US Oral presentation from 08/02/2009 to 14/02/2009.

Catherine De Clercq

- "XI Conference on Topics in Astroparticle and Underground Physics (TAUP 2009)", Rome, Italy - 01-05/07/2009
- "General Scientific Meeting BPS", Hasselt, Belgium - 01/04/2009
- "IAP P6/11 General meeting", Université Catholique de Louvain - 22/01/2009
- "IAP P6/11 general meeting", Vrije Universiteit Brussel Conference organisation - 02/10/2009
- "Symposium in honour of Stefaan Tavernier", Vrije Universiteit Brussel Conference organisation - 15/10/2009

Gilles De Lentdecker ????

- "IEEE Nuclear Science Symposium 2009", Orlando, USA Oral presentation 25-31/10/2009,
- "IEEE Nuclear Science Symposium 2009", Orlando, USA Session chair-person from 25-31/10/2009.

Julie Delvax

- "DIS09", Madrid, Spain - 25-30/04/2009

Laurent Favart

- "DIS09", Madrid, Spain - 26-30/04/2009
- "TAUP09", Rome, Italy - 01-05/07/2009
- "EPS09", Krakow - Poland - Oral presentation - 16-22/07/2009

Tomas Hreus

- " XVII International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2009)", Madrid, Spain - Oral presentation - 26-30/04/2009

Alexis Kalogeropoulos

- CMS Physics Days", CERN, Geneva, Switzerland - 22-26/03/2010.

Mathieu Labare

- "IceCube Collaboration meeting", Madison, WI, USA - Oral presentation - 28/04-03/05/2009

Joris Maes

- "Top Quark Meeting", Geneva, Switzerland - Oral presentation - 06-08/07/2009
- "Belgian Physical Society meeting", Hasselt, Belgium - 01/04/2009

Michael Maes

- "CMS Week", CERN, Geneva, Switzerland - 7-11/12/2009

Pierre Marage

- "Workshop on the Future of CERN", CERN, Geneva, Switzerland - 11-13/05/2009
- "17th International Workshop on Deep-Inelastic Scattering and QCD " DIS2009", Madrid, Spain - Oral presentation, Conference organisation - 25-30/04/2009
- "13th International Conference on Elastic & Diffractive Scattering (Blois Workshop) - EDS09", CERN, Geneva, Switzerland - Oral presentation - 29/06-03/07/2009

Luca Mucibello

- "International CMS workshop on - Ray data analysis" - Torino, Italy - 10-13/3/2009
- "Interuniversity Attraction Pole meeting" - Louvain-la-Neuve, Belgium - 22/1/2009
- "CMS Physics Week" - Bologna, Italy - 7-11/9/2009
- "Interuniversity Attraction Pole meeting" - Brussels, Belgium - 2/10/2009

Yves Pierseaux

- "Cosmological Constant, Classical Vacuum and Special Relativity", Budapest,, Mathematics, Physics and Philosophy in the Interpretations of Relativity Theory Oral presentation Session organizer Session title:Hyperbolic Geometry and Special Relativity - 04-06/09/2009

Robert Roosen

- "CLAS12 European Workshop on Diffraction in High Energy Physics", Genova, Italy - 25-28/02/2009

Romain Rougny

- "International CMS workshop on CRAFT" - Torino, Italy - 11-13/03/2009
- "Lepton-Photon conference" - Hamburg, Germany - 17-22/08/2009
- "11th ICATPP conference" - Como, Italy - 5-9/10/2009

Michele Selvaggi

- "Lepton-Photon conference" - Hamburg, Germany - 17-22/08/2009

Stefaan Tavernier

- "Rectorenbezoek CERN", CERN, Geneva, Switzerland - 10-11/03/2009
- "CMS meeting", CERN, Geneva, Switzerland - 16-17/03/2009
- "50th Crystal Clear Collaboration Meeting", Marseille, France - Session organizer, Session title:Conference organisation - Session chair-person - 22-23/04/2009
- "CMS meeting", CERN, Geneva, Switzerland - 22-23/06/2009
- "Steering Committee of the Crystal Clear Collaboration", Marseille, France - Session organizer, Session title:Conference organisation - 24/04/2009
- "ClearPEM meeting", Porto, Portugal - 27-29/07/2009
- "SSS/MIC Conference IEEE 2009", Orlando, USA - Oral presentation, Poster - 24/10-01/11/2009
- "51th Crystal Clear Collaboration Meeting", CERN, Geneva, Switzerland - Oral presentation, Session organizer, Session title:Conference organization, Session chair-person - 10-12/11/2009
- "Steering Committee of the Crystal Clear Collaboration", CERN, Geneva, Switzerland - Session organizer, Session title: - 13/11/2009
- "CMS meeting", CERN, Geneva, Switzerland - 07-10/12/2009

Walter Van Doninck

- "EPS_HEP", Krakow Poland - Conference organization, Session chair-person - 16-22/7/2009

Pascal Vanlaer

- "Very High Energy Phenomena in the Universe", Moriond-La Thuile, France - Oral presentation - 1-8/02/2009
- "IPM09: 1st IPM Meeting On LHC Physics", Isfahan, Iran -Oral presentation - 20-24/04/2009

Luc Van Lancker

- "International Conference on Composite Materials --ICCM17", Edinburgh, United Kingdom - 27-31/07/2009
- "European Conference on composite materials -- ECCM13", Stockholm, Sweden - 02-05/06/2008

Pierre Van Mechelen

- "LHeC Workshop" - Divonne-les-Bains, France - 1-3/9/2009

Petra Van Mulders

- "Belgian Physics Society", Hasselt, Belgium - Oral presentation - 01/04/2009
- "CMS Week", Bologna, Italy - 07-11/09/2009
- "CMS Week", Limassol, Cyprus - 23-27/06/2009

Nick Van Remortel

- "ISMD2009, XXXIX International Symposium on Multiparticle Dynamics" - "Golden Sands" , Gomel Region, Belarus - 4-9/9/2009

Pierre Vilain

- "13th International Workshop on Neutrino Telescopes", Venice, Italy - Session chairperson -10-13/03/2009
- "EPS Conference on High Energy Physics", Krakow, Poland - 16-22/07/2009

Ilaria Vilella

- "Frontier Physics at the LHC - CMS Physics Week", Bologna, Italy - 07-11/09/2009
- "Joint General Scientific Meeting 2009 BPS", Universiteit Hasselt, Diepenbeek, Belgium - 01/04/2009

Mateusz Wedrowski

- "50th Crystal Clear Collaboration Meeting", Marseille, France - 22-24/04/2009
- "51th Crystal Clear Collaboration Meeting", CERN, Geneva, Switzerland - Oral presentation - 12-13/11/2009
- "IEEE NSS&MIC", Orlando, Florida, USA – Poster - 25/10-01/11/2009

Gaston Wilquet

- "European Strategy Workshop for Future Neutrino Physics", CERN, Geneva, Switzerland - 1-3/10/2009

XV.2 SCHOOLS

Leonardo Benucci

- Fourth Cern-Fermilab Hadron Collider Physics Summer School - Cern, Switzerland – 6/2009)

Stijn Blyweert

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Joris Maes

- Cern School of Computing (CSC)" Gottingen, Germany from 16/08/2009 to 29/08/2009.

Michael Maes

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Thomas Maes

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Luca Mucibello

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Romain Rougny

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Michele Selvaggi

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

Hans Van Haevermaet

- "BND Graduate School 2009" Rathen, Germany - 13-24/09/2009.

XV.3 TECHNICAL TRAINING

Tomas Hreus

- " QCD and MC lectures" Antwerp, Belgium - 13/11/2008 - 20/02/2009

Pascal Vanlaer

- "Advanced statistics course" CERN academic training - Spring 2009

XVI. RESPONSIBILITIES IN EXPERIMENTS

Stéphanie Beauceron

- Contact person CMS Contact person between Calibration and Trigger group.

Daniel Bertrand

- Member IceCube Collaboration Board
- Member IceCube Executive committee

Barbara Clerbaux

- Chairperson CMS Exotica High pt electron group

Catherine De Clercq

- Principal Investigator for VUB IceCube Collaboration Board
- Member IceCube Spokesperson Search Committee

Gilles De Lentdecker

- Responsible of the Tracker Geometry Validation CMS Tracker Group

Xavier Janssen

- "Representative of the IIHE in the EUDET and LCTPC collaboration boards.

Alexis Kalogeropoulos

- Member / Swifter CMS Tracker / SiStrip,
- SiStrip Service Work CMS DQM SiStrip MuonHLT.

Mathieu Labare

- Member IceCube Commissioning

Pierre Marage

- Member H1 Executive Committee

Benoit Roland

- "Monte Carlo responsible for the Forward Group of the CMS collaboration

Stefaan Tavernier

- Member CERIMED executive committee
- Spokesperson, chairman Crystal Clear Collab Collaboration board
- Member CMS tracker institution board
- Member CMS institution board
- Member CMS finance board

Pascal Vanlaer

- Co-convenor CMS Electron-Photon physics group
- Tier-2 representative CMS Computing
- Tier-2 representative W-LCG W-LCG

Pierre Van Mechelen

- "CASTOR software coordinator
- Convener of Interaction Region working group of LHeC project

Walter Van Doninck

- Coordinator CMS Forward RPC system and YE1 inner end caps

Gaston Wilquet

- Chairperson OPERA Collaboration Board
- Chairperson OPERA Editorial Board
- Member OPERA Analysis Advisory Board

XVII. MEMBERSHIP IN ACADEMIC JURY'S

Daniel Bertrand

- Doctorat ULB "Search for Cosmic sources of high energy neutrinos with the AMANDA-II detector" - Promotor Member ,
- - PhD University of Utrecht "A search for Gamma Ray Burst Neutrinos in AMANDA" - Member .

XVIII. LIST OF PUBLICATIONS, REPORTS AND CONTRIBUTIONS TO CONFERENCES

XVIII.1 PUBLICATIONS

A. *NEUTRINO PHYSICS : OPERA*

The OPERA experiment in the CERN to Gran Sasso neutrino beam.

R. Acquafredda et al. Apr 2009. 60pp.

JINST 4 : P04018,2009.

The Detection of neutrino interactions in the emulsion/lead target of the OPERA experiment.

N. Agafonova et al. Mar 2009. 17pp.

JINST 4 : P06020,2009.

B. *NEUTRINO PHYSICS : ICECUBE*

Extending the search for neutrino point sources with IceCube above the horizon.

By The IceCube Collaboration (R. Abbasi et al.). Nov 2009. 6pp.

Phys. Rev. Lett. 103, 221102 (2009)

First Neutrino Point-Source Results From the 22-String IceCube Detector.

By IceCube Collaboration (R. Abbasi et al.). May 2009. 5pp.

Astrophys. J.701:L47-L51,2009.

Search for high-energy muon neutrinos from the 'naked-eye' GRB 080319B with the IceCube neutrino telescope.

By IceCube Collaboration (R. Abbasi et al.). Feb 2009. 20pp.

Astrophys. J.701:1721-1731,2009.

Determination of the Atmospheric Neutrino Flux and Searches for New Physics with AMANDA-II.

By IceCube Collaboration (R. Abbasi et al.). Feb 2009. (Received Feb 2009). 15pp.

Phys.Rev.D79:102005,2009.

Limits on a muon flux from neutralino annihilations in the Sun with the IceCube 22-string detector.

By IceCube Collaboration (R. Abbasi et al.). Feb 2009. (Received May 22, 2009). 5pp.

Phys.Rev.Lett.102:201302,2009.

The IceCube Data Acquisition System: Signal Capture, Digitization, and Timestamping.

By IceCube Collaboration (R. Abbasi et al.). Oct 2008. 54pp.

Nucl.Instrum.Meth.A601:294-316,2009.

Search for Point Sources of High Energy Neutrinos with Final Data from AMANDA-II.

By IceCube Collaboration (R. Abbasi et al.). Sep 2008. (Received Sep 2008). 5pp.

Phys.Rev.D79:062001,2009.

C. *EP PHYSICS : H1*

Multi-Leptons with High Transverse Momentum at HERA.

By H1 Collaboration and ZEUS Collaboration (F.D. Aaron et al.). DESY-09-108, Jul 2009. 18pp.

JHEP 0910:013,2009.

Deeply Virtual Compton Scattering and its Beam Charge Asymmetry in e^+e^- Collisions at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-09-109, Jul 2009. 21pp.
Phys.Lett.B681:391-399,2009.

Observation of the Hadronic Final State Charge Asymmetry in High Q^2 Deep-Inelastic Scattering at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-09-084, Jun 2009. 18pp.
Phys.Lett.B681:125-133,2009.

Strangeness Production at low Q^2 in Deep-Inelastic ep Scattering at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-095, Apr 2009. 35pp.
Eur.Phys.J.C61:185-205,2009.

Search for Single Top Quark Production at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-09-050, Apr 2009. 22pp.
Phys.Lett.B678:450-458,2009.

Search for Excited Quarks in ep Collisions at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-09-040, Mar 2009. 19pp.
Phys.Lett.B678:335-343,2009.

Inclusive Photoproduction of ρ^0 , K^0 and ϕ Mesons at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-172, Feb 2009. 19pp.
Phys.Lett.B673:119-126,2009.

Events with Isolated Leptons and Missing Transverse Momentum and Measurement of W Production at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-170, 2009. 41pp.
Eur.Phys.J.C64:251-271,2009.

A Precision Measurement of the Inclusive ep Scattering Cross Section at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-09-005, 2009. 35pp.
Eur. Phys. J. C64:561-587,2009

A General Search for New Phenomena at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-173, Dec 2008. 24pp.
Phys.Lett.B674:257-268,2009.

Measurement of Diffractive Scattering of Photons with Large Momentum Transfer at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-077, Oct 2008. 17pp.
Phys.Lett.B672:219-226,2009.

Study of Charm Fragmentation into D^{*+} Mesons in Deep-Inelastic Scattering at HERA.
By H1 Collaboration (F.D. Aaron et al.). DESY-08-080, Jul 2008. 33pp.
Eur.Phys.J.C59:589-606,2009.

D. D. E+ E- PHYSICS : DELPHI

Inclusive single-particle production in two-photon collisions at LEP II with the DELPHI detector.
By DELPHI Collaboration (J. Abdallah et al.). CERN-PH-EP-2008-017, Jun 2009. 15pp.

Phys.Lett.B678:444-449,2009.

Correlations between Polarisation States of W Particles in the Reaction $e^- e^+ \rightarrow W^- W^+$ at LEP2 Energies 189-GeV - 209-GeV.

By DELPHI Collaboration (J. Abdallah et al.). CERN-PH-EP-2009-003, 2009. 20pp.

Eur.Phys.J.C63:611-623,2009.

A Study of b anti- b Production in e^+e^- Collisions at $\sqrt{s} = 130\text{-GeV} - 207\text{-GeV}$.

By DELPHI Collaboration (J. Abdallah et al.). CERN-PH-EP-2008-018, Nov 2008. 21pp.

Eur.Phys.J.C60:1-15,2009.

Search for one large extra dimension with the DELPHI detector at LEP.

By DELPHI Collaboration (J. Abdallah et al.). CERN-PH-EP-2008-013, Aug 2008. 11pp.

Eur.Phys.J.C60:17-23,2009.

E. *P-P PHYSICS : CMS*

Alignment of the CMS Silicon Strip Tracker during stand-alone Commissioning.

W. Adam et al. FERMILAB-PUB-09-543-CMS, CMS-NOTE-2009-002, Apr 2009. (Received Jul 30, 2009). 41pp.

JINST 4 : T07001,2009.

Stand-alone Cosmic Muon Reconstruction Before Installation of the CMS Silicon Strip Tracker.

By CMS Tracker Collaboration (W. Adam et al.). Feb 2009. 29pp.

JINST 4: P05004,2009

Performance studies of the CMS Strip Tracker before installation.

By CMS Tracker Collaboration (W. Adam et al.). FERMILAB-PUB-09-546-CMS, CMS-NOTE-2008-032, Jan 2009. (Received Jun 9, 2009). 40pp.

JINST 4 : P06009,2009.

F. *APPLIED R&D AND SPINOFF*

Development of an anthropomorphic breast phantom for combined PET, B-mode ultrasound and elastographic imaging

Jun Dang, Benjamin Frisch, Philippe Lasaygues, Dachun Zhang, Stefaan Tavernier, Nicolas Felix, Paul Lecoq, Etienne Auffray, Joao Varela, Serge Mensah and Mingxi Wan, submitted to IEEE transactions Med Imaging

Development of anthropomorphic phantoms for combined PET-Ultrasound breast elastography imaging

Jun DANG, Philippe Lasaygues, Dachun Zhang, Stefaan Tavernier, Nicolas Felix, Benjamin Frish, Serge Mensah and Minxi Wan, Proceedings of the IEEE Nuclear science symposium and medical imaging conference, Orlando, October 2009

XVIII.2 CONFERENCE PROCEEDINGS

A. APPLIED R&D AND SPINOFF

Robustness of Machine Learning Algorithms for Gamma Detection in Positron Emission Tomography,
Mateus Wędrawski, Peter Bruyndonckx, Stefaan Tavernier, ZhiLi, Jun Dang, Pedro Rato Mendes,
Jose Manuel Perez and Karl Ziemons
Proceedings of the IEEE Nuclear science symposium and medical imaging conference, Orlando, October 2009

Characterisation of the ClearPEM Breast imaging scanner performance
Joao varela, S. Tavernier, et al., Proceedings of the IEEE Nuclear science symposium and medical
imaging conference, Orlando, October 2009
Philippe Lasaygues, Dachun Zhang, Stefaan Tavernier, Nicolas Felix, Benjamin Frish, Serge Mensah and
Minxi Wan,
Proceedings of the IEEE Nuclear science symposium and medical imaging conference, Orlando, October 2009

XIX. CMS NOTES

CMS NOTE-2009/002 -- CMS Tracker Alignment at the Integration Facility
W. Adam, P. Van Mechelen, W. Beaumont, E. A. de Wolf, E., O. Bouhali, O. Charaf, B. Clerbaux, J.-P.
Dewulf, S. Elgammal, G. Hammad, G. de Lentdecker, P. Marage, C. Vander Velde, P. Vanlaer, J. Wickens
V. Adler, O. Devroede, S. De Weirtdt, J. D'Hondt, R. Goorens, J. Heyninck, J. Maes, M. Mozer, S. Tavernier,
L. Van Lancker, P. Van Mulders, I. Vilella, C. Wastiels, et al.

CMS NOTE-2009/003 -- Track Reconstruction with Cosmic Ray Data at the Tracker Integration Facility
W. Adam, P. Van Mechelen, W. Beaumont, E. A. de Wolf, E. O. Bouhali, O. Charaf, B. Clerbaux, J.-P.
Dewulf, S. Elgammal, G. Hammad, G. de Lentdecker, P. Marage, C. Vander Velde, P. Vanlaer, J. Wickens
V. Adler, O. Devroede, S. De Weirtdt, J. D'Hondt, R. Goorens, J. Heyninck, J. Maes, M. Mozer, S. Tavernier,
L. Van Lancker, P. Van Mulders, I. Vilella, C. Wastiels, et al.

CMS NOTE-2009/005 -- Reception Test of Petals for the End Cap TEC+ \ of the CMS Silicon Strip Tracker
The Tracker End Cap Collaboration R. Bremer , V. Adler, W. Beaumont, O. Bouhali , E. Chabanat, E.
Chabert, B. Clerbaux, J.-P. Dewulf, J. D'Hondt , R. Goorens, , J. Heyninck, G. de Lentdecker, ,et al.

CMS NOTE-2009/009 -- Integration of the End Cap TEC+ of the \ CMS Silicon Strip Tracker
The Tracker End Cap Collaboration V. Adler, W. Beaumont, O. Bouhali, E. Chabanat, E. Chabert, B.
Clerbaux, J.-P. Dewulf, J. D'Hondt, R. Goorens, J. Heyninck, G. de Lentdecker, S. Tavernier, C. Vander
Velde, P. Vanlaer, L. Van Lancker, E. de Wolf, V. Zhukov, et al.

CMS NOTE-2009/013 -- Distributed Analysis in CMS
A. Fanfani, ,J. D'Hondt,et al.

CMS CR-2009/088 -- CMS Analysis Operations
J. Andreeva, J. D'Hondt, J. Maes, P. Van Mulders, I. Vilella,et al.

CMS CR-2009/093 -- Debugging Data Transfers in CMS
G. Bagliesi, J. D'Hondt , J. Maes, P. Van Mulders, I. Vilella, et al.