Europe Egypt Network for Particle Physics
الشبكة الأوروبية المصرية لفيزياء الجسيمات

SEVENTH FRAMEWORK PROGRAMME

European Commission

EENP2

Reports from Egyptians researchers seconded to EU

Amr Radi   Antonious Tamer Salama Salwa Rabie H Kamel

Reports from Mai Elsawy

I visited ECOLE for two months, from August to September 2014 and from ECOLE I had the opportunity to visit the European particle physics laboratory CERN in Geneva, Switzerland, for training and preparation of my PhD thesis. The FP7 EENP2 sponsored the trip.

I worked on my Ph.D thesis project on a physics analysis topic in the CMS experiment, under the supervision of Prof. Dr. Albert De Roeck. The thesis subject is to prepare and engage in a search for Dirac monopoles for the new collision energy of 13 TeV, the data taking of which will start in spring 2015.

I had some elementary preparation in programming language C++ before coming to Europe and upon arrival, I got immediately engaged into the learning and exercising with the analysis tools of the CMS experiment, such as ROOT, the simulation and reconstruction software, the specific event generator for the monopoles and our system of GRID computing. The analysis environment of the CMS (or any LHC experiment) is very 'heavy' because it must be a multi-purpose environment for a many different analyses, and it has to serve over 3000 people. Hence, it is essential for a efficient development of a PhD thesis to spends some time in an informed environment to get a proper training and preparation, i.e. to be surrounded by people that are knowledgeable and can help to overcome issues and problems. Two months are in fact not sufficient to get a full training, but it allows learning the basic aspects and preparing for the specific thesis subject. The face-to-face contact with the experts is invaluable.

I was able in ramping up in the project, and by the end of my visit I was able to perform analyses in ROOT (specifically to the thesis topic, see below), submit jobs on the grid, and simulate and reconstruct Monte Carlo at 13 TeV.

The return to the Egyptian community from such a visit had large potential, to get more trained people in the country.

A second goal was to confer with the monopole analysers that are completing presently the 8 TeV analysis. This analysis is intended to be a starting point for the 13 TeV data taking and subsequent analysis, but it will need to be adapted and re-optimized. I had frequent meetings with the proponents of the 8 TeV analysis on the details of that study. Three main topics were identified for the first phase of the thesis project, namely:

- Reproducing some of the basic 8 TeV results in CMS. I was given a root-tuple to work with and successfully reproduced the main features and plots/distributions of the 8 TeV analysis. This was an important step to understand the basics of the experimental components and objects relevant for her future study, the basic features of the analysis, and to get some in depth insight in the physics questions ahead.
- The generation of Monte Carlo events at 13 TeV and study of the kinematics at this new centre of masse energy, and compare with the kinematics of the events 8 TeV to evaluate the strategy for the 13 TeV data analysis. This task was accomplished and the results are according to expectation for the production of these massive particles at the higher collider energy.

- The study of the trigger for the 13 TeV data taking. No monopoles will be collected if there is no trigger in the experiment selecting the monopole candidate events. The signature of the monopoles in the parameter space that we can study with the CMS experiment will consists of a highly ionizing track that will stop in the detector and

deposit all its energy in the electromagnetic calorimeter (ECAL). Hence, the trigger will consist mostly of one or two large clusters of electromagnetic energy in the ECAL, eventually connected with a track but which bends differently compared to an ordinary charged particle track in the CMS. The monopoles are expected to release their energy very locally in the ECAL crystals, often just all contained in one crystal with a high-energy signal, depending on the impact position of the monopole on the crystal grid. CMS has an issue with spurious signals in the single crystals caused by backgrounds hitting directly the avalanche photo-diode (APD) readout, called spikes. To mitigate this background CMS has introduced so called spike killers in the trigger, which unfortunately also kills a substantial fraction of our signal: in the 8 TeV analysis the trigger acceptance is of order 20% for the signal, but it is expected to be worse at 13 TeV due to the stronger conditions put on the trigger. I have been linked up with the ECAL and Exotica trigger experts to discuss with them a possible strategy to increase the signal acceptance without accepting more background. I learned how to use the sophisticated trigger tools from the CMS HLT group, and got the chain to work from MC to reconstructed data simulation for signal, and to work in addition with a real data file at 8 TeV, used for the background studies. Hurdles on the way included the fact that CMS has now upgraded its software to CMSSW version 7, which as always causes issues and problems, but these were eventually all ironed out and after that, the systematic study of the various trigger improvements started. This task is ongoing right now, and much awaited for by the ECAL trigger experts.

The trigger studies need to be concluded as soon as possible in order to have full impact for the start of the run, which would be the data sample on which my thesis will be based. The next steps included to set-up an analysis chain starting form the one of the 13 TeV data analysis. We also anticipate to investigate new directions, not used right now in the analysis, such as double monopole detection, the usage of the tracker information (as monopoles bend unusually in the magnetic field), and the use of signal timing which can be very precise in the ECAL. So there is a lot of potential to be explored to make an excellent thesis, and CERN experts encourager us strongly to continue to follow that road.

In summary, my visit was very successful. I had the opportunity to prepare the thesis project through interaction with the core experts and has in place an environment for the first planned studies. The first results were produced and many more will now follow rapidly as the technical hurdles have been passed. Hence, I think I had a good training into the subject I am working on. However, since the amount of information to absorb in CMS is vast, the formation should be definitely continued in Egypt with local training of more general aspects of the CMS environment.

Reports from Sherif Elgammal

I have been invited by Prof. Philippe Miné (LLR - École polytechnique, 91129 Palaiseau Cedex, France.) to spend two months at LLR laboratory, in the framework of CMS experiment, from 24 June to 21 August 2014. The visit was financed by "EENP2" FP7 grant, PIRSES-GA-2012-318922, and by Egyptian Network for High Energy Physics (ENHEP).

The aim of this visit was to work on high energy di-muon pairs for the analysis in preparation for the 2015 data by the Compact Muon Solenoid (CMS) experiment [1]. This analysis can lead to the discovery of new physics. In particular new gauge groups (Z' decaying to mu+ mu- and W') from Grand Unified Theories (GUT) [2, 3], or extra spatial dimensions (Kaluza-Klein excitation "Graviton"). The discovery of these new particles could be shown up through modifications to the Standard Model Drell-Yan pair production [6], and through heavy resonance production.

The collaboration with the French partner, represented by Prof. Philippe Miné, and with the Italian Prof. Nicola De Filippis leads to many scientific activities.

- Initiating a new framework for the analysis for the search for new heavy gauge boson "Z'" decaying to di-muon in preparation for run2. This was achieved by re-producing the 2012 results by CMS using the new *framework. In the* preparation for 2015 data taking by the CMS detector, we performed a study for the possible discovery of new physics in the di-electron or di-muon channel. This discovery should be observed first as a deviation in the invariant mass plot of the main irreducible background, which is Drell-Yan [2] distribution. The spin determination of this new heavy boson is important to know the nature and then the model, which predicts this particle. The main quantity, which determines directly the particle spin, is angular distribution. The angular distributions, based on Collins Soper frame [7, 8], have been studied in the framework of high-energy electron pairs (HEEP). For the di-muon channel, a study was done to study the efficiencies of the high pt muon identification variables using N-1 techniques. Then computing the total ID efficiency using Tag and Probe technique, as computed at the Z boson pole (60 < M < 120 GeV).

- The new framework has been used to check and to test the new central production by CMS for the preparation for LHC run2 upgrading.

List of the presented talks
* Z' to mu mu analysis: status report, for Z' to dimuons Italian meeting, Thursday, 25 September 2014
https://indico.cern.ch/event/317920/contribution/0/material/slides/0.pdf

* Study Of HEEP ID V5 in miniaod format, for HEEP Meeting, Monday, 22 September 2014
https://indico.cern.ch/event/341840/contribution/2/material/slides/0.pdf

* High pt Muon ID in CSA14 Exercise, for Z' to dimuons Italian meeting, Thursday, 11 September 2014
https://indico.cern.ch/event/317918/contribution/1/material/slides/0.pdf

* Test code on 2012 data, for Z' to dimuons Italian meeting, Thursday, 7 August 2014
https://indico.cern.ch/event/317913/contribution/1/material/slides/0.pdf

Reports from Ahmed Ali Abdelalim

I started my CMS activities with the EENP2 FP7-PEOPLE-2012-IRSES. The current project helped me a lot to get into the CMS experiment and introduced me to the CMS community. During the first visit to Bari University (from 1st of September until 31st of October 2013), I discover the CMS software and started my analysis. At that time, I joined the Gas Electron Multiplier (GEM) project for the CMS upgrade. My role in GEM project was to produce all the Monte-Carlo samples needed for Physics Performance studies. Therefore, I produced some signal samples for GEM physics studies:

- o Higgs to ZZ* to four muons.
- o Higgs to tau tau
    - ▪ gg to H to tau tau
    - ▪ WH to lnu + tau tau
- o Higgs to mu mu
    - ▪ gg to H to mu mu
    - ▪ WH to lnu + mu mu
    - ▪ ZH to ll + mu mu
- o Exotics signals
    - ▪ Z' to mu mu
    - ▪ W' to mu nu
    - ▪ mu mu* to mu mu Z to 4 muons
- o Minimum Bias samples
- o

During the 2nd visit to Bari University (from 29th June till 22nd August 2014) using the grant EENP2 FP7-PEOPLE-2012-IRSES, I started my analysis on Z' to 2 muon analysis with the Z' di-moun Italian group. Now I am preparing this analysis for the CMS run II.

- **General activity :**

    - o Participated in the Egyptian School on High Energy Physics. I gave the training session on the philosophy of HEP simulation programs taking PYTHIA as an example. I also gave the training session on how to use the physics analysis package (ROOT) tutorial. ROOT tutorial material as well as necessary ROOT files and macros, I prepared especially for the school, are found here http://dpnc.unige.ch/~abdelalim/ROOT_tutorial
    - o Talk on the ICTP international conference "Higgs and Beyond the Standard Model Physics at LHC" international conference scientific", 24th – 28th June 2013, Miramare, Trieste, Italy.
    http://indico.ictp.it/event/a12189/session/53/contribution/40/material/0/0.pdf

    - o Talk on the ICTP external scientific meeting SMR2619: "Advanced Workshop on LHC Physics and Cosmology", 3rd – 14th February 2014, Cairo, Egypt.
    http://wlcapp.net/confs/ICTP_2014_SMR2619/ScientificProgram.html

    - o Talk on the 1st Workshop on Applications of Physics in Life and Industry, 22nd October 2014, Physics Department, Faculty of Science, Benha University.

- **Publications :**

o Abdelalim, A, Hammad, A & Khalil, S, 'B-L heavy neutrinos and neutral gauge boson Z' at the LHC', Phys. Rev. D. December 2014, https://journals.aps.org/prd/accepted/a3078Ye5Gf21c94720399163d1a4ad7ee0a0bd291

o 'CMS TECHNICAL 4 DESIGN REPORT FOR THE MUON ENDCAP UPGRADE: GE1/1 - THE STATION 1 GEM PROJECT' – GEM collaboration, CMS experiment Nov. 2014. https://indico.cern.ch/event/326478/material/1/0.pdf

o 'Performance of a Large-Area GEM Detector Prototype for the Upgrade of the CMS Muon Endcap System' Proc. 2014 IEEE Nucl. Sci. Symposium, Seattle, WA. Dec. 2014 arXiv:1412.0228v2 [physics.ins-det].

o 'Upgrade of the CMS muon system with triple-GEM detectors', *JINST* **9** C10036 doi:10.1088/1748-0221/9/10/C10036.

Report from Moustafa Eshra

I have been invited by Prof. Philippe Miné (Laboratoire Leprince-Ringuet (LLR) - École polytechnique, 91129 Palaiseau, Cedex, France) to spend three months at LLR laboratory from 15 August to 14 November 2013, in the framework of CMS experiment. The visit was financed by "EENP2" FP7 grant, PIRSES-GA-2012-318922, and by Egyptian Network for High Energy Physics (ENHEP).

The CMS (Compact Muon Solenoid) detector has been designed to study proton-proton and heavy ion collisions produced by LHC (Large Hadron Collider), to search for new particles and physics processes. The CMS trigger system is organized in two consecutive steps Firstly the Level-1 trigger performs an event selection (custom-made electronics processors) based on coarse energy deposits in the calorimeters and the muon systems (output rate up to 100 kHz). As second step, the HLT (high-level trigger) implements precise selection algorithms (in commercial computers) based on finer granularity and higher resolution information from all sub-detectors in regions of interest identified at L1 (output rate about 300 Hz). Electromagnetic calorimeter (ECAL) provides a precise measurement of energies and particles of the electron and photons. The CMS ECAL, composed of a Barrel (EB) and two Endcaps (EE), comprises 75848 lead tungstate-scintillating crystals is equipped with avalanched photodiode (APD) or vacuum phototriode (VPT) light detectors.

Anomalous signals, consisting of isolated large signals, have been observed in the ECAL Barrel during LHC proton-proton collisions data taking in CMS during 2009-11. These deposits, termed ECAL "spikes" are observed to occur at a rate that is proportional to the luminosity. It happened because of the collision of the neutron particles with the APDs. Therefore, they present issues for triggering CMS at high luminosity and must be eliminated from physics analyses in order to prevent large biases in the energies of reconstructed electrons, photons and jets. At high luminosity, these would be the dominant component of the 100 kHz CMS L1 trigger rate bandwidth.

In the CMS ECAL the energy of an electromagnetic (EM) shower is distributed over several crystals, with up to 80% of the total energy in a central crystal (where the electron/photon is incident) and most of the remaining energy in the four adjacent crystals. This lateral distribution can be used to discriminate spikes from EM (electromagnetic) signals.

The study of spikes was performed with different parameters like the number of events, transverse energy of the electron and the maximum energy of the crystals on full 2012 data (Run A,B,C,D) at 8 TeV on CMSSW_5_3_7 (CMS reconstruction software). A tree has been made while looping on the data, extracting the information we need, and then applying the cuts on this information to draw the Swiss-cross, which represent the spikes signal and finally construct the histograms we need. That was done with Cint programming language using Root program. A detailed study has been made to study either the Spikes are low p_t phenomena or high p_t, so the spikes has been studied at different central energy crystal and we discovered that it is low p_t phenomena. One can see the detailed study and all of the plots presented in my talk at the WP1 meeting.

List of the presented talks:
(1) HEEP meeting, 2 September 2013, "Spike in L1 trigger and offline".
"https://indico.cern.ch/conferenceDisplay.py?confId=268792"
(2) WP1 meeting, 25 September 2013, "Report"
"https://indico.cern.ch/conferenceDisplay.py?confId=274856".
(3) WP1 meeting, 23 October 2013, "Study Spikes in the offline and elimination online".

"https://indico.cern.ch/conferenceDisplay.py?confId=279245 ".

Report from Ashraf Mohamed Kasem

I was invited by Prof. Philippe Miné (LLR Écolep Plytechnique), together with Mohamed Elshamy, to spend one month at LLR laboratory, in the framework of (Grid Computing), from 11 September to 11 October. "EENP2" FP7 grant, PIRSESGA2012318922, and Egyptian Network financed the visit for High Energy Physics (ENHEP).

The aim of the visit was to take a technical background about how to build a Grid site to help us to implement our grid node in Egypt at ASRT (Academy for Scientific Research and Technology). The grid node in Egypt will also serve Egyptian HEP community.

From the moment of arrival, we found eight virtual machines to try to build a virtual grid node to build a complete node to be able to work again in Egypt. I performed the installation taking three steps:

- For first time we installed a grid with (1 worker node + 1 computing element + Tbdii + Sbdii + DPM_disk+ DPM_mysql + UI) with the help of local expertise;

- Second we try to repeat and install grid from scratch as we start to install operating systems, repos, middware (EMI3) and configuration for all machines;

- Finally I tried to exchange machined and configure again the node.

I also performed the Installation and configurations of XROOTD and CVMFS software.

Soon afterwards, I moved to Bari invited by prof. G. Iaselli, also in the framework of the EENP2 FP7-PEOPLE 2012 IRSES project. I joined the group at the Physics Department of Politecnico di Bari to collaborate on research activity related to the Work Package 3 "GRID computer applications" from 11 Oct 2013 to 11 Nov 2013.

The aim of the visit was to take a technical background about how to work with CMS related software (CRAB, PhEDEx) and monitoring and to complete our grid training.

I was working on:

- PHEDEX Installation;
- Installation and configuration of monitoring tool called Zabbix_server, the database required for this tool MYSQL database and the front end for the server;
- Installation and configuration of monitoring tool called Zabbix_Agent;
- Installation and configuration of monitoring tool called Zabbix_Proxy and the database required for this tool MYSQL database;
- How to monitor the Agent - node monitoring;
- Proxy monitoring;
- Adding new host machine start monitoring using Active and passive host registration;
- Create and run Python scrip on agent and get the result on server front end;
- Create template, item, trigger and graph to monitor the agent;
- Create new users and give the privileges to users;
- Testing Zabbix installation and it was working well.

Report from Ahmed Qamesh

I have been invited by Prof. Giuseppe Iaselli (Bari university, Italy) to spend one month in the Department of Physics, in the framework of CMS experiment, from 1 June to 30 June 2014. The visit was funded by "EENP2" FP7 grant and by Egyptian Network for High Energy Physics (ENHEP).
The aim of this visit was to learn some techniques on data analysis and to be familiar with LHC experiment and Compact Muon Solenoid (CMS).

I started my work under the supervision of Prof. Nicola De Fillipis in the analysis of Z' decaying to mu+ mu. The aim of our search was to prepare an analysis that could be used to ensure the existence of a new particle called Z prime. This analysis is supposed to be applied practically on CERN data 2015 (Run 2). The work was not easy, as I was not familiar with any kind of this analysis. I started from zero level, learning the CMSSW software, and then doing some extra exercises related to root analysis. I have also attended many seminars during this interval and I gave three talks about my progress, comparing results and discussing many issues with other experts.

After returning to Egypt, I decided to continue working in Z prime analysis; I have already made a seminar in Cairo University in October 2014 about this topic trying to introduce my new work and transfer it to the others.
In order to improve my skills in Data analysis, I participated at the CMSDAS school in Bari, Italy (19-23 January, 2015), where I learned lots of extra things in data analysis by participating in two short exercises (tracking/ vertexing- RooFit/RooStat) and another long one (invisible Higgs). At the end of this school, I gave a talk about the analysis techniques used to analyse the invisible Higgs decay modes at 13 Tev.

Report from Asmaa Fawzi Ali Hassan

During my visit at the Department pf Physics in POLIBA, I collaborated on the preparation for the W' → μν analysis at 14 TeV, especially using Missing Transverse Energy (MET) algorithms. I studied some recommended optional filters to select true MET signals and reject various instrumental and reconstruction effects, which could simulated cause fake MET signals.
I implemented in my analysis the following filters:

- **CSC beam halo filter:** filter beam halos using CSC info;
- **HBHE noise filter:** HBHE HPD & RBX noise rejection;
- **ECAL dead cell filters (trigger primitive & boundary energy filter):** remove events losing large energy in the dead cell region;
- **HCAL laser filter:** remove events with laser firing at wrong times;
- **Tracking failure filter:** remove events with too few tracks;
- **Bad EE Supercrystal filter:** to remove events with crystal regions, which give anomalously high energies;
- **EB or EE Xtals with large laser calibration correction:** to reject events with energetic crystals that have unphysically large laser correction values (> 3.0 in EB and > 8.0 in EE);
- **Tracking odd events filters (tracking POG filters):** to remove events with (partly) aborted track reconstruction and affected by the Strip Tracker coherent noise;
- **Muon inconsistency filter:** remove events in which the pf muon Pt and reco muon Pt are discrepant by > 10%;
- **Greedy muon filter:** remove events with pf muon wrongly absorbing calo E > muon P;
- **EE ring-of-fire filter:** remove events with anomalous high hits in EE.

I performed the study on LHC data and MonteCarlo data for the W' → μν analysis at 14 TeV. The results of the MET algorithms with and without filter were compared to understand the best case for the future analysis.

Report from Reham Mohamed Aly

I had the opportunity to join for two different period the POLIBA group to work on the discovery of a Higgs boson in ZZ to 4 leptons decay and the measurements of its properties.

The purpose was to run the full H->ZZ->4l analysis on 2011+2012 data and Fall011+Summer012 Monte Carlo samples. During the first period, I have initially studied the strategy to estimate the background from data, using fake rate method, in order to subtract it form the signals.
I have then studied the selection strategy for observables (object selection) and for full event selection.
The objects selection efficiency was measured by Tag and Probe method (measuring lepton reco, ID and isolation performance).
During the second visit, I have prepared the Datacards for H -> ZZ -> 4l statistical analysis used for limit calculation, p-value of discovery and width measurement etc.
I have also participated in the preparation of the Higgs analysis at 14 TeV. The phenomenology study on H-> ZZ* ->4 μ at $\sqrt{s} = 14$ considering integrated luminosity of 300 fb-1 of pp collisions (Run II) is crucial for the following years-The analysis strategy consists in to picking up two pairs of opposite-charge muons, compatible with a ZZ* system, appearing as a narrow resonance on top of a smooth background. On this work, I am preparing an internal publication in Egypt.

> **Seminars:**
1- "Higgs analysis in 4 muon channel with CMS detector" EENHEP annual collaboration meeting: session WP1, January 22-23, 2014, Cairo, Egypt.
2- "Higgs analysis in 4 muon channel with CMS detector" Student session, ICTP SMR2619: Advanced workshop on LHC physics and cosmology, February 3-14, 2014, Cairo, Egypt.
3- "Phenomenology study on H-> ZZ* ->4 μ at $\sqrt{s} = 14$" EENHEP annual collaboration meeting: session WP1, November 13, 2014, Cairo, Egypt.

> **Papers:**
4- CMS internal AN published 14-111_V4.
5- "Study of the higgs boson decaying to four muons at $\sqrt{s} = 14$", The Egyptian Society of Nuclear Science and Applications (ESNSA).
6- 'CMS TECHNICAL 4 DESIGN REPORT FOR THE MUON ENDCAP UPGRADE: GE1/1 - THE STATION 1 GEM PROJECT' – GEM collaboration, CMS experimaent Nov. 2014. https://indico.cern.ch/event/326478/material/1/0.pdf
7- 'Performance of a Large-Area GEM Detector Prototype for the Upgrade of the CMS Muon Endcap System' Proc. 2014 IEEE Nucl. Sci. Symposium, Seattle, WA. Dec. 2014 arXiv:1412.0228v2 [physics.ins-det].
8- "Upgrade of the CMS muon system with triple-GEM detectors", *JINST* 9 C10036 doi:10.1088/1748-0221/9/10/C10036.
9- Performance of the gas gain monitoring system of the CMS RPC muon detector Published inJournal of Instrumentation Volume 10 January 2015 2015 JINST 10 C01003 doi:10.1088/1748-0221/10/01/C01003
10- Resistive plate chambers for 2013-2014 muon upgrade in CMS at LHC Published in Journal of Instrumentation Volume 8 October 2014
2014JINST 9 C10033 **doi:10.1088/1748-0221/9/10/C10033**
11- CMS RPC tracker muon reconstruction Published in**Journal of Instrumentation Volume 9 October 2014** 2014 *JINST* **9** C10027 doi:10.1088/1748-0221/9/10/C10027

Report from Ahmed Sayed Ali

I had the opportunity to join for two different period the POLIBA group to work on the RPC trigger system of the CMS experiment.

The trigger systems of LHC detectors play a fundamental role in defining the physics capabilities of the experiments. A reduction of several orders of magnitude in the rate of collected events, with respect to the proton-proton bunch-crossing rate generated by the LHC, is mandatory to cope with the limits imposed by the readout and storage system. There are two levels of the trigger system in CMS experiment. The Level-1 trigger is implemented using custom electronics, while the High Level Trigger (HLT) is based on software algorithms running on a large cluster of commercial processors, the Event Filter Farm.

I studied the trigger performance-using run 229684 & 229713 of the Monitor Stream Data.
In detail, I contributed on the following items:

- Studying the stability of Trigger Rate with MAGNET ON.
- Studying the stability of luminosity section.
- Studying Triggers Rate for RPCb and RPCf.
- Studying RPCb and RPCf triggers quality.
- Studying the triggers towers Eta range for RPCb from -0.07 to 0.07.

I also made a study of the RPC RecHits distributions for the following cases:

- RE-1, RE-2, RE-3 and RZ plots
- W+2, W+1, W+0, W-1 and W-2

Finally, I did some preliminary analysis of the current drown by the RPC chambers.
Samples of plots illustrates I vs HV relationship, the procedure consists in measuring the current (Imon) for several High Voltage (HV) values (HV scan).

Report from Mohamed Elshamy

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Report from Shereen Aly

This report describes the two activities have been performing during my visits at the POLIBA Physics Department.

1- Gamma Irradiation facility (GIF) measurements

The goal of this activity was to study the performance and aging effects while exposing the muon detectors to sustained hit rate of gamma irradiation, meanwhile to install and test the DAQ system that is required for the telescope in Helwan University.

The Gamma Irradiation Facility (GIF) is a test area to study the performance of the particle detectors under gamma irradiation. The main target of GIF activity is to study the performance and the rate capability of the muon chambers under LHC-like conditions. The chambers have been exposed to sustained hit rate around 1 KHz/cm^2.

The DAQ system has been installed successfully at the CERN lab and validated by comparison with previous results obtained with simple NIM counter. The hardware and DAQ system were then moved to the GIF in order to perform some studies on new and old CMS production chambers. The goal was to measure the chamber performance with cosmic muons at different gamma background conditions

In conclusion, the hardware and software needed for cosmic muon telescope was installed, first in the laboratory then at the Gamma Irradiation facility of the CERN.

The performance of the new RPC CMS chambers have been obtained using our system. The comparison with and without gamma background was studied.

2- Fast simulation studies

The goal of this activity was to investigate which physics channel could be profit from the use the use of timing detector that needed to be installed in the eta region (1.8<eta<2.4). The ratio of the events containing two muons in the high eta region (1.8<eta<2.4) was computed. The fraction of events for H $\rightarrow$ μ^+ μ^- and H $\rightarrow$ tau$^+$ tau$^-$ was evaluated. I used Madgraph5 +Delphes.

- H $\rightarrow$ μ^+ μ^-

The ratio of the leading muons in the high eta region(1.8<eta<2.4) is calculated by :No. of events in high eta /No. of events in the whole eta range of the detector. Several steps have been done in order to make sure that the two leading muons coming from higgs are in the same Eta region(1.8<eta<2.4).

- H $\rightarrow$ tau$^+$ tau$^-$

Same procedure applied on previous case.

I found a fraction of events in the high eta region of 2.7% and 3.2%, respectively.

Report from Ahmed Ibrahim

This report describes the activity I have been performing during my visits at the POLIBA Physics Department.

I was involved in RPC construction and performance certification to acquire basic knowledge on the gaseous detector operation. I have been fully integrated in the construction and test team, also frequently joining the CERN laboratory. My training was preparatory to the development of a similar facility at the HELWAN University.

I started with the selection of good gas gaps for the chamber assembly. The gap quality control was divided in two steps:
QC-1: it consists of a visual inspection of the gaps in order to discern damaged panels during the gap construction.
QC-2: it includes test for spacer bonding, gas leak and dark current measurements of the gaps with high voltage.

The first part of the QC-2 is to check the mechanical stability of the gas gap. To secure the uniform electric field within the gas gap, homogeneous 2 mm separation is achieved by using some spacers. The secure bonding of the spacers on the surface of the bakelite electrode has to be checked. The pressure variation of the gaps, when the spacer is pressed, is recorded is recorded by PLW. Another property of the gas gap to be checked as QC-2 is the gas leakage rate.
The dark current measurement has three steps. The first part is an HV scanning up to 10 kV. Finally, the "dark current" is measured as HV increases up to 10 kV. In this step, the amount of current drawn by the gaps at 6 kV should not exceed 1.5 μA. At 10 kV, a maximum value of 5 μA and 10 μA is allowed for small gaps and large gaps, respectively.

Following step is the assembly of the chamber using the gaps that have passed the certification. After the assembly, the chamber are validated with a cosmic rays telescope. The testing area is located in the CERN RPC laboratory. It is equipped with crane, low and high voltage power supplies, gas-distribution lines, weather stations and data acquisition systems(DAQ). It consists of metallic towers where chambers can be placed horizontally and read out in coincidence with the passage of triggering muons. A maximum of ten chambers can be tested simultaneously. Temperature in the halls is kept constant by air-conditioning systems.
The a muon trigger system is provided by a set of 10 scintillators located on the top and bottom of the test tower. The gas mixture is composed of 96.2% $C_2H_2F_4$, 3.5% iso-C_4H_{10} and 0.3% SF_6 and it is distributed via parallel system to the chambers. Water vapor is also added to humidify the operating gas within 40–45%. The gas composition is monitored and known with a relative precision better than 1%. The values of humidity, temperature and pressure are monitored by Weather Station. A summary of the chamber performance is stored into the RPC Production Database together with all the information about the environmental conditions. Data for each chamber are accessible through a web interface.

Report from Ola Aboamer

I was invited to visit the POLIBA Physics Department in autumn 2014, sponsored by the FP7 EENP2 project. During my stay in Bari, I developed a new updated version of the EENP2 WWW page. In this short report I briefly list the main instructions to manage the web site.
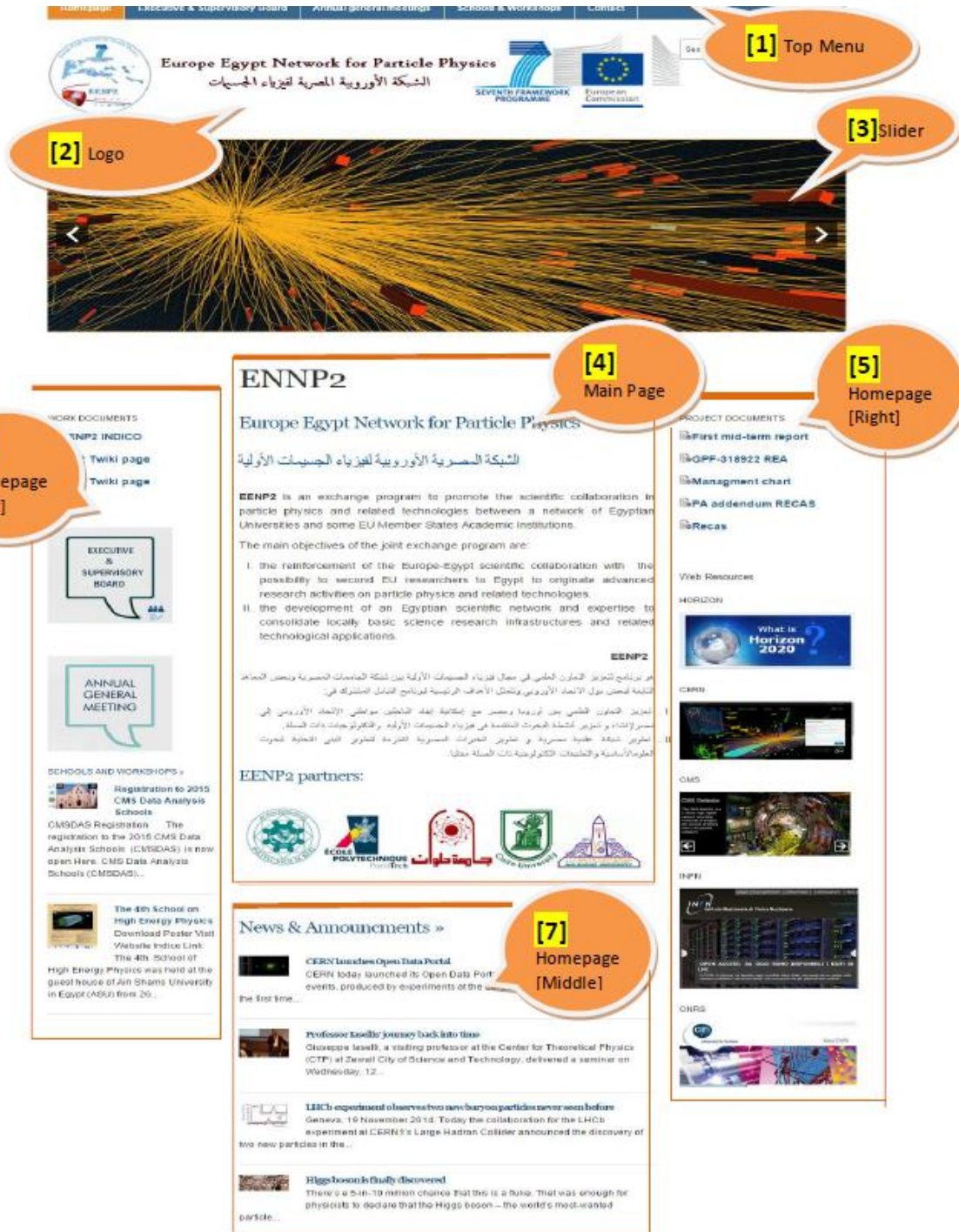
[1] Modification of the Top Menu

To Edit the Header menu Go to Admin dashboard

\>> Go to "Appearance" in the left side sidebar

\>> Click "Menus"

\>> You can see the "Menu Structure" block where you can edit [rearrange, add new field … etc].

[2] Modification of the Logo

\>> Go to "WPZOOM" in the left side sidebar

>> Click "Theme Options"
>> You can see the "Theme settings" block where you can upload new Logo.
Hint: *Consider the dimensions.*

[3] Modification of the Slider
>> Go to "Slideshow" in the left side sidebar
>> Click "Add a new slide" or edit one of the listed Slides by clicking one of them.
>> To upload a photo inside the slide edit/create Click on Set featured image in the right side bar.
Hint: *You must place a title for the slide.*

[4] Modification of the Main Page
>> Go to "Pages" in the left side sidebar
>> Click on the page called "EENP2" in the shown list edit the content in the Textarea .
Hint: *use the "Visual" tab not "Text".*

[5] Modification of Homepage [Right]
>> Go to "Appearance" in the left side sidebar
>> Click "Widgets"
>> You can see the Right two blocks where you can edit [re-arrange widget's elements, add new widget's element … etc].
>> expand the widget called "Sidebar: Homepage (Right)", now you can edit the elements inside the right sidebar.

[6] Modification of Homepage [Left]
>> Go to "Appearance" in the left side sidebar
>> Click "Widgets"
>> You can see the Right two blocks where you can edit [re-arrange widget's elements, add new widget's element … etc].
>> expand the widget called "Sidebar: Homepage (Left)", now you can edit the elements inside the left sidebar.

[7] Modification of Homepage [Middle]
>> Go to "Appearance" in the left side sidebar
>> Click "Widgets"
>> You can see the Right two blocks where you can edit [re-arrange widget's elements, add new widget's element … etc].
>> expand the widget called "Sidebar: Homepage (Middle)", now you can edit the elements inside the Middle block.

Internal Pages:
1) Executive & Supervisory Board
>> Go to "Pages" in the left side sidebar
>> Click on the page called "Executive & Supervisory Board" in the shown list edit the content in the Textarea.
Hint: *use the "Visual" tab not "Text".*

2) Annual general meetings
>> Go to "Pages" in the left side sidebar

>> Click on the page called "Annual general meetings" in the shown list edit the content in the Textarea.
Hint: *use the "Visual" tab not "Text".*

3) Contact
>> Go to "Pages" in the left side sidebar
>> Click on the page called "Contact" in the shown list edit the content in the Textarea.
Hint: *use the "Visual" tab not "Text".*

News And Announcements:
To add new News or Announcement
>> Go to "Posts" in the left side sidebar
>> Click "Add new"
>> Add Title into the input field up, body into the text area.
>> Add Post image by clicking set featured image in the right sidebar "featured image" block.
>> You **MUST** attach this post to a category, select "News" from the right sidebar "Categories" block.
Hint: *Select only one category.*

Schools and Workshops:
To add new school or workshop
>> Go to "Posts" in the left side sidebar
>> Click "Add new"
>> Add Title into the input field up, body into the text area.
>> Add Post image by clicking set featured image in the right sidebar "featured image" block.
>> You **MUST** attach this post to a category; select "Schools&Workshops" from the right sidebar "Categories" block.
Hint: *Select only one category.*

Other:
1) To upload photo to the site
>> Go to "Media" in the left side sidebar
>> Click "Add new"