JEROME SAMARATI

Address :8,rue du Petit Malbrande
74100 Annemasse, FRANCE
Tel :+ 33 609 01 63 03
Email address :jerome.samarati@gmail.com

Date of birth :March 24th, 1973
Nationality :French
Single
No more military obligations

PhD in Nuclear Physics

Professional experiences

10/2011-07/2013 : PostDoc *LAPP laboratory, France*
Activity : Research and study on the discharges phenomena in micropattern gaseous detector (MicroMegas).

03/2008-07/2011 : PostDoc *TERA fundation, Italy*
Activity : Development of a medical instrument (Proton Range Telescope) dedicated to medical imaging and beam diagostic.

12/2005-12/2007 : PostDoc *INFN Cagliari, Italy*
Activity :Tests on the wire chambers used on the Dimuon Arm of the ALICE experiment at CERN.

03/2000-01/2001 : Institut de Radiophysique Appliqué *Lausanne, Switzerland*
Work in the nuclear medicine department of the hospital on the attenuation correction in SPECT.

Education

11/2002-11/2005 : PhD in Physics *Subatech laboratory, France*
Subject of thesis :"Development and characterisation of a micropattern gaseous detector dedicated to the β imaging".

03/2001-12/2001 : Master in Medical Radiation Physics *University of Wollongong, Australia*
Subject of thesis :"Optimisation of energy window on a γ camera with ^{201}Tl for image quality improvement".

08/1994-06/1998 : Applicant in Applied Physics Section *Ecole d'Ingenieurs de Geneve, Switzerland*
Subject of diploma :"Thin protective layer deposition on photocathods".
Work realised at the Weizmann Institute of Sciences, Israël.

Computer skills

- Windows (word, excel, powerpoint)
- Linux (C++ programming, root graphic interface, Geant 4 simulation)

Languages

- French:mother tongue
- English:fluent
- German:school knowledges
- Italian :Good knowledges

Publications

L. Luquin, R. Dallier, P. Laloux, M. Leguay, P. Leray, S. Lupone, V. Métivier, E. Morteau, J. Samarati, N. Servagent, D. Thers, G. Charpak, P. Coulon and M. Meynadier, *Parallel Ionization Multiplier (PIM): application of a new concept of gaseous structure to tracking detectors*, Nucl. Instr. And Meth. A 518 (2004) 135-138.

J. Samarati, G. Charpak, P. Coulon, M. Leguay, P. Leray, S. Lupone, L. Luquin,V. Métivier, M. Meynadier, E. Morteau and D. Thers, *β-imaging with the PIM device*, Nucl. Instr. And Meth. A 535 (2004) 550-553.

D. Thers, Y. Bedfer, J. Beucher, P. Coulon, F. Kunne, M. Leguay, V. Lepeltier, P. Leray, S. Lupone, L. Luquin, V. Métivier, E. Morteau, D. Neyret, J. Samarati and N. Servagent, *New prospects on particle detection with a Parallel Ionization Multiplier (PIM)*, Nucl. Instr. And Meth. A 535 (2004) 562-565.

J. Beucher, S. Girault, P. Leray, S. Lupone, L. Luquin, V. Metivier, E. Morteau, J. Samarati, N. Servagent and D. Thers, *Parallel ionization multiplier : A gaseous detector dedicated to the tracking of minimum ionization particles*, Nucl. Instr. And Meth. A 573 (2007) 294-297.

U. Amaldi, W. Hajdas, S. Iliescu, N. Malakhov, J. Samarati, F. Sauli and D. Watts, *Advanced Quality Assurance for CNAO*, Nucl. Instr. And Meth. A 617 (2010) 248-249.

D. Watts, N. Malakhov, L. Ropelewski, J. Samarati and F. Sauli, *Performance of MPGDs with Portable Readout Electronics*, Nuclear Science Symposium Conference Record, 2008. NSS '08.IEEE, 919-924.

D. Watts, U. Amaldi, A. Go, Y. H. Chang, W. Hajdas, S. Iliescu, N. Malakhov, J. Samarati, F. Sauli, *A proton range telescope for quality assurance in hadrontherapy*, Nuclear Science Symposium Conference Record (NSS/MIC), 2009 IEEE, 4163-4166.

U. Amaldi, A. Bianchi, Y-H. Chang, A. Go, W. Hajdas, N. Malakhov, J. Samarati, F. Sauli and D. Watts, *Construction, test and operation of a proton range radiography system*, Nucl. Instr. And Meth. A (2011) 337-344

Summary of Job Experience

Overview of 'diplome d'ingenieur' carried out at the Weizmann Institute of Sciences

The work consisted of studying and fabricating photocathods to be integrated in novel gaseous photomultipliers for photon detection in a wide spectrum from ultra-violet to visible. In particular the detection of Cherenkov light in the near ultra-violet to the blue visible would augment the detection efficiency of elementary particles in RICH (Ring Imaging CHerenkov) detectors. Such photo detectors, working in this spectral domain, could also be used to record the light emitted from scintillators bombarded by gamma radiation. This offers important applications in medical imaging or in biological research. The best known photocathods, used in photomultipliers, are composed of K_2CsSb and are characterized by their high performance in the visible spectrum but also for their reactivity. For this reason, they cannot be used in multipliers based on the principle of avalanche. It was thus necessary to find a way to protect them to allow use in a gaseous environment without altering their qualities. The first part of this work consisted of building the photocathode along with its protective coating. The system developed by the group of professor A. Breskin is based on the evaporation of the photocathode K_2CsSb on a substrate of quartz and then, also by evaporation, the deposition of a protective cover of CsI or CsBr having a few Angstroms thickness. The second part of the work consisted in observing the behaviour of the main properties of the photocathods (quantum efficiency and ageing). The quantum efficiency and the ageing were tested as a function of different parameters such as: the presence of water vapour and oxygen, the thickness of the protection layer, the intensity of photon flux incident, and the intensity to bombardment by ions produced in the avalanche.

Overview of Master of Science carried out at the University of Wollongong

The goal of this work was to study the effect of diffuse radiations on the image quality obtained in nuclear medicine and to optimize the width of the energy window such that the image has the greatest possible spatial resolution (FWHM) with the use of Thallium 201 (^{201}Tl). The improvement of the image quality is an important problem in nuclear medicine to be able to diagnose tumours at an early stage. The use of ^{201}Tl is frequent for medical imaging using gamma-cameras in the case of the diagnostics of cardiac pathologies. Images were obtained from Monte-Carlo simulation codes for different geometries of the module detector-collimator-source by using the gamma part of the code MCNP 4A (Monte-Carlo N-Particles 4A). The effect of scattered radiation in the spectrum of each scintillator crystal was demonstrated for different positions of the source in air and in a phantom filled with water. The ratio diffuse/photoelectric was simulated for all depths of the source in the water. The obtained images were characterized using the full-width at half maximum (FWHM) of the spatial resolution as the parameter of image quality. In order to verify the simulations, real measurements were carried out with ^{201}Tl linear and point sources in a water phantom with the help of a dual-head camera from General Electric and different energy windows. The measurements taking into consideration the energy resolution of the detector are in agreement with simulations. The experimental result gives the best spatial resolution for a point at 5cm depth in the water phantom of 7.2 mm. The energy window for these results has an upper threshold at 73.9 keV and lower threshold at 58.1 keV for an average energy of 66 keV (ΔE = 15.8 keV). The best resolution (FWHM) obtained by simulation was 2.5mm for identical conditions as those measured with an energy window of 15 keV (from 55 to 70 keV).

Work realized during the PhD thesis at Subatech Laboratory

This work was devoted to the development and characterization of a gaseous micro-pattern detector dedicated to β autoradiography. This imaging technique is frequently used in research laboratories in biology as well as in the pharmaceutical industry. Based on the technique of molecule labelled by a radioelement (β^- emitter), this type of imaging offers an excellent spatial resolution (of the order of several tens of microns). The electrons emitted by the radioelement are generally of low energy (E_{mean} = 6 keV and E_{max} = 18.6 keV for ^{3}H and E_{mean} = 49.5 keV and E_{max} = 156 keV for ^{14}C) which implies a very short range in the material and the emission is isotropic. The samples were slices of mices'tissues whose contain labelled molecules. These slices were placed under slides of a microscope. Since a long time, autoradiography could be realised by means of films. This technique has an excellent spatial resolution, but suffers from a low sensitivity to β^- rays which would require prohibitive exposure times.
To adapt to the constraints imposed by autoradiography, the INCADE group developed a new type of gaseous micro-pattern detector called PIM (Parallel Ionization Multiplier) derived from the principle of MicroMegas. This detector has an asymmetric geometry particularly suited to autoradiography. The first stage, with a thickness of several hundred microns, in contact with the source permits to amplify primarily the electrons created close to the source by the avalanche phenomenon, limited drastically by the parallax effect. The second stage is a drift space in which charge created in the first stage are separated and steered under the effect of a weak electric field introduced by a current on the anode plate consisting of tracks in two directions. The calculation of the centre of the collected charge by the readout electronics allows for determining the emission point on the sample. The two stages are separated by a micro-mesh which defines the electric field for each space. One part of the work consisted in finding a geometry which would allow an image of multiple slices to be made simultaneously as well as studying the optimal characteristics (gas mixture, applied voltage, thickness of spaces, shielding, etc.) connected with the geometry. The development of a new readout electronics capable of working at a frequency on the order of 10 kHz as well as the realisation of the trigger electronics constituted a second important step in this work. The last concerned the reconstruction code written in C++ which allowed to plot emission points on the screen from the raw data sent by the acquisition system. Many parameters of the code needed to be optimized such as the charge cut and the cluster size in order to have an image without artefacts and with the desired spatial resolution. The results obtained were very encouraging. On the surface of a slice we obtained a spatial resolution (FWHM) of 50 μm with ^{3}H and 60 μm with ^{14}C.

Work carried out during two years of postdoctoral position within the INFN in Cagliari

The section of the INFN in Cagliari is involved in the ALICE experiment of CERN and notably in the branch 'dimuon'. The detectors making up the muon spectrometer are wire-chambers developed to detect muons coming from the disintegration of meson J/PSI or Y with a possible observation of a new kind of matter, the quark-gluon plasma (QGP). One part of my work consisted of testing the wire-chambers, under high-voltage in order to ensure that no short-circuits or over-loading were present which could pollute the measurements. A systematic inspection for gas leaks was also realised in order to certify that the gas mixture ($Ar:CO_2$) was being correctly used in the chambers. The third part of the testing campaign was to verify the readout chain by connecting the readout cards on their connectors and reading the pedestal. This allowed to check the connectivity of the readout plane as well as the right value of pedestal. The second part of my work was carried out at CERN on the ALICE detector itself where I mounted the previously tested detectors on their supports and connected them to the gas circuit and various electrical connections (high-voltage for the detectors and low voltage for the readout electronics). Finally, we carried out an other test campaign in the same manner as mentioned before in order to assure the correct functioning of the detector in the real environment of the experiment.

Work carried out during 3 years as a research associate at the TERA Foundation

The TERA foundation is an Italian foundation which develops accelerators and instruments dedicated to the field of medicine. The project I was involved in was the development and realisation of a proton telescope where the goal was to verify the characteristics of a proton beam (Bragg peak) used in proton therapy and also to realise a proton radiography.
The instrument is composed of 30 scintillators of 3mm thickness each and two scintillators (10mm thick, for the trigger). The idea is to measure the residual range (the penetration) of protons coming from a mono-energetic proton beam and passing through an object and stopping in the scintillators. With this information, it is possible to determine the integral density of the traversed object. On top of this are added two gaseous detectors (triple GEMs, Gas Electron Multipliers) which allow a measurement of the X and Y position of each proton. With this information and that of the residual range provided by the scintillators, it is possible to create a radiography of the unknown object traversed by the proton beam.
My work consisted mainly of simulation work of the instrument using GEANT4 Monte-Carlo code in order to assure the feasibility of the project as well as the characteristics of the instrument. A second part was the construction and test of the different parts of the instrument itself. The first step was the construction of the two triple-GEM detectors and then the measurement of their gain and homogeneity using an X-ray source (8.9 keV). The second step was the realisation of the scintillator telescope. Using a groove cut along one side of each scintillator we were able to glue in a wavelength shifting (WLS) fibre and then to mount a solid-state photomultiplier (SiPM) which converts the light emitted by the fibre into an electronic signal used by the acquisition system. All the scintillator modules were then tested individually using a ^{106}Ru electron source in order to determine the response of each scintillator as a function of the applied voltage to the SiPM. Once the testing phase was completed, the mechanical phase began. The complete telescope (the instrument with its readout electronics as well as software for control and data acquisition) was taken to the Paul Scherrer Institute for a series of tests (calibration of the SiPM gain, use of absorbers to observe the displacement of the Bragg peak, and the radiography of an object) using a proton beam. The telescope showed very promising results such as a density resolution of 3.8%, a resolution along the residual proton range of 1.7 mm rms and a spatial resolution (in X and Y given by the GEM detectors) of 1.6 mm rms.