Marie Curie for Particle Detectors

Excellent training opportunities for young researchers in the field of radiation detectors for the next generation of particle physics experiments and other applications

- **14 Collaborating Partners**:
  - ✓ 9 Academic Participants
  - ✓ 2 Associated Academic Partners
  - ✓ 3 Industrial Partners
- **12 Research Projects**
- **21 Researchers around Europe**:
  - ✓ 18 PhD students and 3 PostDocs
    → at CERN 3 PhD students and 1 PostDoc

Academic Network Participants:
- Major European High Energy Physics research laboratories
- Large research institutes with proven long standing record in the design and fabrication of state-of-the-art particle detectors

Industrial Partners:
- European small/medium size high tech companies with leading role

European Multi-site Initial Training Network

DESY Hamburg
Stefano Caiazza (P5): **TPC with MPGD Readout**
Jiaguo Zhang (P2): **Hybrid Pixel Detectors**
Cristina Pirvutoiu (P3): **Radiation Hard Crystals / 3D Detectors**

NIKHEF
Francesco Zappon (P9): **Front-end Electronics for Hybrid Pixel Detectors**
Rolf Schoen (P5): **TPC with MPGD Readout**

DESY Zeuthen
Olga Novgorodova (P6): **Very Forward Calorimetry**

AGH
Jonathan Aguilar (P6): **Very Forward Calorimetry**
A K Prasoon (P11): **Front-end Electronics**
Imran Ahmed (P10): **Monolithic Detectors**

GSI
Rahul Arora (P5): **TPC with MPGD Readout**
Shahinur Rahman (P11): **Front-end Electronics**
Tomas Balog (P1): **Radiation Tolerant Mini-strip Tracking Detectors**

PSI
Jennifer Sibille (P2): **Hybrid Pixel Detectors**

JSI
Ruben Verheyden (P8): **Photodetectors for High B-Field**
Marko Milovanovic (P3): **Radiation Hard Crystals / 3D Detectors**

CERN
Nicola Pacifico (P1): **Radiation Tolerant Mini-strip Tracking Detectors**
Mary Tsagri (P12): **Optimization of MC Tools and Comparison with Benchmark Data**
Marco Villa (P4): **Micro Pattern Gas Detectors**
Paolo Beltrame (P7): **Advanced Photodetectors**

LNF
Jing Dong (P4): **Micro Pattern Gas Detectors**
Filimon Roukoutakis (P12): **Optimization of MC Tools and Comparison with Benchmark Data**

Unique set of competencies, expertise, infrastructures and training possibilities

13/14 January '09, CERN **Kick-off Meeting**

17 – 19 September '09, AGH Cracow **First Network Training Event** on **Electronics**

28 – 30 January '10, DESY Hamburg **Second Network Training Event** on **Detector Simulation and Data Analysis**

27 – 29 September '10, Ljubljana **Third Network Training Event** on **Processing and Radiation Hardness of Solid State Detectors**

TRAINING FOR EUROPE
13-17 SEPTEMBER 2010

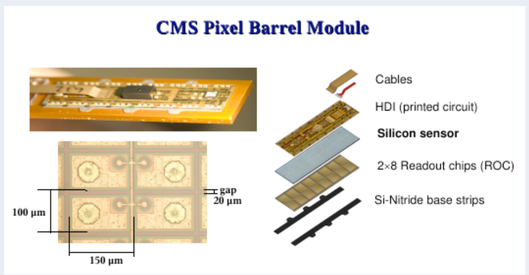
This research project has been supported by a Marie Curie Initial Training Network Fellowship of the European Community's Seventh Framework Program under contract number (214560 MC-PAD)

Marie Curie for Particle Detectors

Hybrid Pixel Detectors

Jennifer Sibille (at PSI, April 09)
USA (18/8/1984)
PhD St. at University of Kansas

Aim of the Project:
Radiation-hard hybrid pixel detectors for LHC and SLHC.
My work:
- ✧ measurements and simulations of the properties of hybrid pixel detectors, specifically the CMS barrel pixel detector
- ✧ Effect of radiation damage on the silicon sensors
- ✧ Test beam at the H2 beamline at CERN of the pixel efficiency as a function of radiation fluence



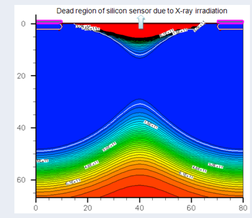
Training:
- ✧ German language courses
- ✧ ICFA School on Instrumentation in Elementary Particle Physics (Argentina)

Being a MC-PAD:
Being chosen as a MC-PAD fellow has allowed me to gain a lot of experience. I would not have been able to get otherwise. I am able to work closely with the detectors and experts, and to meet many other people in the same area of research.

Future plans:
I plan to continue working in the field of particle physics research and hope to get a post-doc position after the end of my MC-PAD experience.

Jiaguo Zhang (at DESY Hamburg, July 09)
China (24/5/1984)
PhD St. at University of Hamburg

Aim of the Project:
Radiation hard silicon pixel detector for next generation experiments at the European X-ray Free Electron Laser (XFEL).



My work:
- ✧ Measurements and model calculation for CMOS capacitors and gate-control diodes
- ✧ Microscopic parameters extraction of surface charges due to X-ray irradiation
- ✧ Correlation of microscopic parameters and macroscopic properties
- ✧ Radiation damage of segmented silicon sensors
- ✧ Optimization of pixel sensor design with TCAD simulation (in the following year)

Training:
- ✧ German language course benefits from DESY
- ✧ Summer school on "Gearing up for LHC Physics" in Zuoz
- ✧ SPICE and TCAD simulation, Geant and ROOT
- ✧ Thermally Stimulated Current (TSC) technique

Being a MC-PAD:
The MC-PAD training network provides a lot of opportunities for early stage researchers to get to know more about detectors. As a member of this network, I gained much experience on the detector development and many chances to either work or discuss with experts in this field.

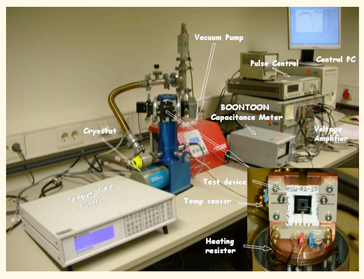
Future plans:
Based on the knowledge on the design of silicon detectors that I will benefit from the MC-PAD network, I plan to join in the first silicon detector laboratory in IHEP of China and continue to work on the fabrication of silicon detectors for scientific studies in the future.

Radiation Hard Crystals / 3D Detectors

Cristina Pirvutoiu (at DESY Hamburg, September 09)
Romania (6/9/1984)
PhD St. University of Hamburg

Aim of the Project:
Find best hard radiation silicon material for SuperLHC.
My work:
- ✧ Identifying and characterizing irradiation induced bulk defects
- ✧ Microscopic (Deep Level Transient Spectroscopy, Thermally Stimulated Current) and
- ✧ Macroscopic (CV, IV measurements) parameters correlation

Training:
- ✧ Learning of the Deep Level Transient Spectroscopy (DLTS) and CV/IV measurements
- ✧ Thermally Stimulated Current technique
- ✧ Capacitance Deep Level Transient Spectroscopy technique
- ✧ SPICE simulation
- ✧ PSI Zuoz summer school on high energy physics
- ✧ German language courses at DESY

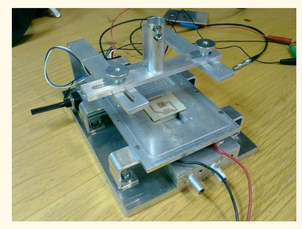


Being a MC-PAD:
Offers the chance to work in an high scientific environment, provides the possibility to benefit of trainings and participate to conferences in the detectors field and not only, in this way you can gain a lot of experience. Also enhance the possibility to meet and discuss with people in the same research field.

Future Plans:
I would like to continue my career in research area especially in the semiconductor detectors either as a post-doc or as a researcher in the private industry.

Marko Milovanovic (at JSI, August 09)
Serbia (6/11/1980)
PhD St. University of Ljubljana

Aim of the project:
Develop and test new material for LHC upgrade.
My work:
- ✧ Measurements and analysis of highly irradiated silicon sensors using Edge-TCT and Alibava read-out system
- ✧ effects of radiation damage on detector properties - effects of annealing
- ✧ performance investigation of 3D detectors



Training:
- ✧ Slovene language course
- ✧ Safety course at Nuclear Training Center (ICJT-JSI)
- ✧ Readout electronics, detector simulation and data analysis

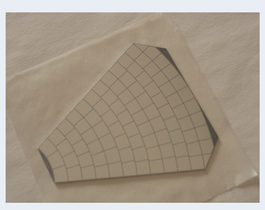
Being a MC-PAD:
An extraordinary experience working in an international research community, excellent training opportunities, access to the world's greatest institutes. Simply priceless.

Future Plans:
After MC-PAD, sky is the limit.

Very Forward Calorimetry

Olga Novgorodova (at DESY Zeuthen, May 09)
Russia (2/2/1984)
PhD St. at Lebedev Physical Institute

Aim of the Project:
Radiation resistance study for future calorimetry application.
My work:
Inside FCAL collaboration to work on preparation of a fully equipped prototype module for performance studies.



Training:
- ✧ German language courses
- ✧ C++ course
- ✧ Presentation skills training
- ✧ Tutor on the second MC-PAD training event

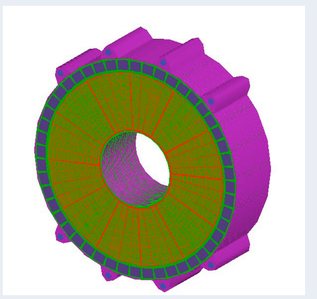
Being a MC-PAD:
I would like to thank MC-PAD for giving me a chance to continue my experience in radiation resistent material for calorimetry. It is a great opportunity to participate in the construction of the radiation hard beam calorimeter.

Future plans:
I would like to continue my career in physics and especially in calorimetry.

Jonathan Aguilar (at AGH, January 09)
USA (7/2/1986)
Msc. St. at AGH-UST Krakow

Aim of the Project:
Luminosity calorimeter for ILC.

My work:
- ✧ Simulating the behavior of our proposed LumiCal design
- ✧ Preparing the prototypes for test beam analysis
- ✧ Identification of important contributions to energy resolution from physical irregularities in the detector design
- ✧ Preparation of the sensor and electronics prototypes for analysis in a test beam.
- ✧ Collaboration meeting at CERN, DESY and Tel-Aviv
- ✧ Test beam of other sensor systems in preparation for LumiCal's



Training:
- ✧ Pay for my Masters' courses
- ✧ Summer schools in particle/accelerator physics
- ✧ Polish language courses

Being a MC-PAD:
Applied for the MC-PAD program for a chance to work on an important and fascinating international collaboration, to join a network of young scientists, and for the wealth of training opportunities it offers us.

Future plans:
After MC-PAD, I plan to pursue my PhD.

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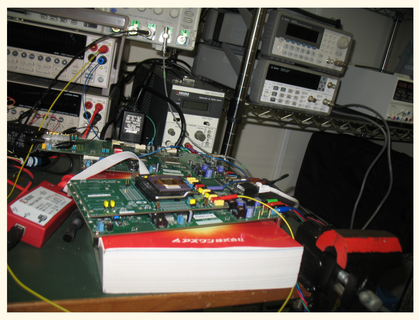
Monolithic Detectors

Imran Ahmed (at AGH, September 09)
India (9/3/1983)
PhD Student at AGH-UST Krakow

Aim of the Project:
Radiation hardness and readout speed for future B-factory and ILC.
My work:
✧ Investigation of CMOS-based Monolithic Active Pixel Sensors (MAPS) detector development and covers MAPS design readout electronics detector irradiations and testing vertex detector layout studies
✧ Monolithic CMOS SOI detector measurement of leakage current response to red light illumination irradiation with radiation sources testing of available test transistors on the detector



Training:
✧ Polish language course
✧ Training on monolithic CMOS SOI detector measurement at KEK
✧ Belle II Computing workshop at IFJ-PAN, Krakow

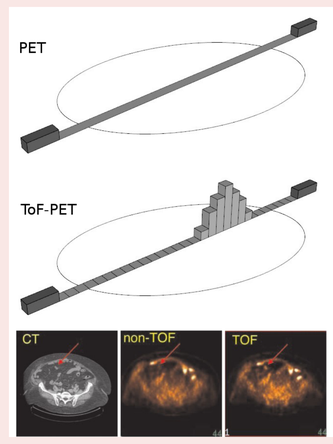
Being a MC-PAD:
Offers the chance to learn from experts and work in an international environment. As a member of this network, I gained much knowledge on the detectors.

Future plans:
I would like to finish my PhD and try to get a job position in the field of monolithic detectors as a researcher.

Photodetectors for High B-Field

Ruben Verheyden (at JSI, February 09)
Belgium (11/5/1982)
PhD St. at University of Ljubljana

Aim of the Project:
Time of flight PET with Silicon Photomultiplier.
My work:
✧ Using ToF information from the positron-electron annihilation event
✧ More accurate localization of the annihilation event
✧ Enhancement of the signal-to-noise ratio
✧ Using SiPM (magnetic field insensitive) to incorporate a PET scanner inside a MRI, giving the possibility to make 2 different complementing scans at the same time
✧ Energy resolution around 15% FWHM
✧ Timing resolutions of ~340 ps for back-to-back gammas



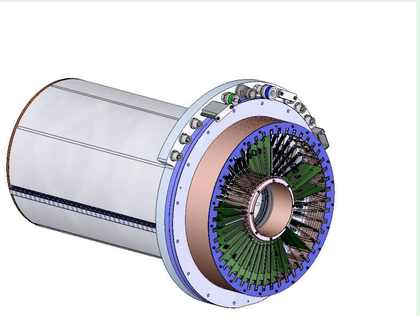
Training:
✧ ICFA School on Instrumentation in Elementary Particle Physics (Argentina)
✧ 1st EIROforum School on Instrumentation, CERN (CH)

Being MC-PAD:
Extending my experience in detector hardware and electronics.

Future plans:
After my MC-PAD experience I intend to continue working in the field of particle physics detector hardware either through a post-doc position or R&D in the private industry.

Rahul Arora (at GSI, May 09)
India (2/9/1985)
PhD. St. at University of Frankfurt

Aim of the Project:
Development of the Time Projection Chamber detector for the central tracker of PANDA experiment at FAIR.
My work:
✧ Building a prototype TPC detector with GEMs as amplification stage
✧ Testing in FOPI experiment at GSI and CB-ELSA experiment at Bonn
✧ Fabrication and testing of the detector
✧ The first prototype will be almost ready and going to be tested in September at FOPI with the antiproton beam



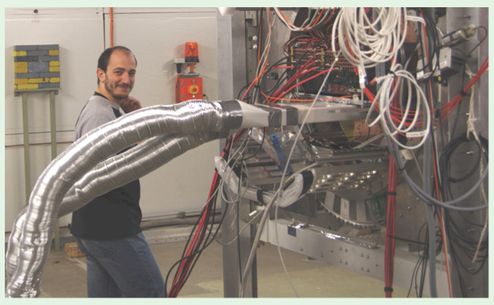
Training:
✧ German language course
✧ RD51 Meeting at CERN
✧ PANDA collaboration Meeting
✧ CERN school of computing

Being a MC-PAD:
The experience helped me to meet the experts in the field of detectors and readout electronics.

Future plans:
I want to pursue my career in research especially in detector physics.

Stefano Caiazza (at DESY Hamburg, June 09)
Italy (9/8/1982)
PhD. St. at University of Hamburg

Aim of the Project:
Development of GEM based readout system for a TPC detector, foreseen for the ILD experiment at the future ILC.
My work:
✧ Development of a GEM based module for the ILD-TPC prototype
✧ Basic Research on GEM technology
✧ Design of the module
✧ Assembly and commissioning of the module
✧ Test of the device in the DESY test beam on the ILD-TPC prototype



Training:
✧ German language course
✧ Hadron Collider Physics Summer School 2010
✧ Readout electronics
✧ Statistical Analysis
✧ Physical simulation and modeling

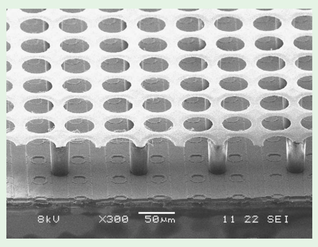
Being a MC-PAD:
MC-PAD granted me access to the international research community in an easy and rewarding way.

Future plans:
I'd like to continue my research work, maybe in the academic world or in the private sector. But my experience with MC-PAD has been so good up to this moment that I would consider to apply to another MC project if I find one that suits me.

TPG with MPGD Readout

Rolf Schön (at NIKHEF, May 10)
Germany (11/8/1984)
PhD St. at University of Amsterdam

Aim of the Project:
Study of discharges in micro-pattern gas detectors.
My work:
✧ Improvement of the GridPix detector: a 14 mm x 14 mm pixel read-out gas detectorchip with an integrated amplification grid on top
✧ Study the cause of discharges due to non-uniformities of the composing material and/or electric field
✧ Preventing the discharges or the damages to the detector



Training: (not started yet)

Being a MC-PAD:
Opportunity to work on an interesting international research program in a foreign country, expanding not only my language skills but also my working experience in an international group.

Future plans:
After the MC-PAD program I will finish the last year of my PhD at Nikhef. Afterwards, I would like to continue the research in the field of micro-pattern gas detectors as Post-doc in an European country (France, Switzerland, Italy).

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Marie Curie for Particle Detectors

Frontend Electronics

A K Prasoon (at AGH, September 10)

India (7/2/1984)
PhD Student at AGH-UST Krakow

Aim of the Project:
Development of ASIC required for the ILC.
My work:
✧ Test and characterization of 10 bit pipeline ADC
✧ Design and verification of command decoder for custom SPI for 10 bit pipeline ADC
✧ Ongoing development of 2 wire interface for data converters using I2C as backbone

Training:
✧ Advanced Analog Implementation flow (at AGH)
✧ FCAL collaboration meeting

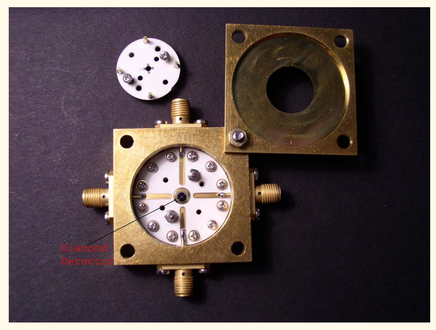
Being a MC-PAD:
I find the MC-PAD fellowship very prestigious and fulfilling. There is very good research guidance and adequate funding to successfully carry out assigned work.

Future plans:
I would like to complete my Ph.D. during this MC-PAD tenure and to continue my research in Mixed Signal circuit design.

Shahinur Rahaman (at GSI, June 09)

Bangladesh (30/10/1976)
PostDoc at GSI

Aim of the Project:
Radiation hard and ultra fast detectors for GSI and FAIR (*Facility for Antiproton and Ion Research*) experiment.
My work:
✧ Electrical characterization of CVD Diamond for Detector Applications
✧ Front End Electronics (FEE) of diamond detectors & setups in the BEAMTIME data acquisition
✧ Programs, e.g. CAMDA (data acquisition & analysis), SRIM, LabVIEW, MathCAD, etc.



Training:
✧ Programming language courses
✧ German language courses

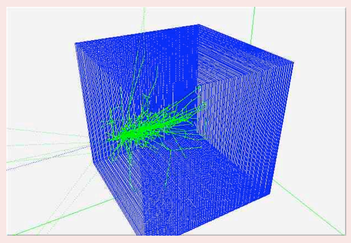
Being a MC-PAD:
MC-PAD fellowship would prove a unique opportunity to have vast experiences and to widen knowledge in the field of experimental Nuclear/Particle detectors under the guidance of experts.

Future plans:
To be involved extensively in the experimental particle detectors in a well-reputed and renowned research institutes (like GSI, CERN, etc.) or in an industry.

Filimon Roukoutakis (at LNF, April 10)

Greece (27/6/1978)
PostDoc at LNF

Aim of the Project:
Calorimetry simulation for the KLOE-2 upgrade.
My work:
✧ Detailed simulation of lead/scintillating fibre (Scifi) calorimeters of different structures using Monte Carlo tools (Fluka, Geant4), relevant to evaluate and improve their energy response and sensitivity to neutrons.
✧ Two simulation programs with Fluka/Geant4 to describe neutron interaction on calorimeters
✧ Geant4 version in close collaboration with the CERN group
✧ Qualification of the programs with dedicated data-MC comparisons
✧ Extensive use of benchmark data of neutron interaction on calorimeters taken with the KLOE detectors



Training:
✧ Few weeks for training in Geant4 (at CERN)
✧ Collaborate with Fluka experts in Milan
✧ LNF Spring School "Bruno Touschek" in Nuclear, Subnuclear and Astroparticle Physics
✧ ESOF2010 EuroScience Open Forum in Turin

Being a MC-PAD:
This is my second Marie Curie fellowship. Being a post-doctoral researcher in a prestigious Marie Curie ITN as MC-PAD is a great opportunity for me to reach a higher level of professional maturity. My aim is for a constant and consistent presence in research and in the continuous development of scientific knowledge.

Future plans:
Obtain a tenure-track research position or a physics simulation-related job position.

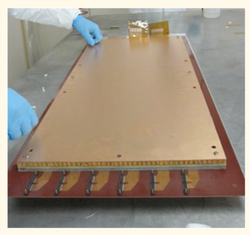
Optimization of MC Tools and Comparison with Benchmark Data

Mary Tsagri
(at CERN, December 08)

Jing Dong (at LNF, November 09)

China (02/1981)
Post Doc at Laboratori Nazionali di Frascati

Aim of the Project:
KLOE detector upgrade.
My work:
✧ Inner Tracker between the beam pipe and the Drift Chamber
✧ Ready for the installation by the end of autumn 2011
✧ Construction and test of the large area planar GEM with final XV readout and front-end electronics at the T9-PS beam CERN facility
✧ Microsector upgrade
✧ Pic measurements and TCAD simulation to optimize the design of the detectors



Training:
✧ Italian language course
✧ Safety course at LNF
✧ Garfield and ROOT

Being a MC-PAD:
I'm experiencing the 'metamorphosis' from a Ph.D student to a scientist and enjoying how to operate the career development myself.

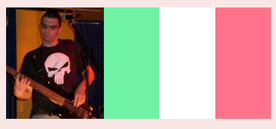
Future plans:
Possibly taking advantage of the experience on GEM detectors, I will participate to the design and construction of the Inner Tracker for BESIII experiment in Beijing.

Micro Pattern Gas Detectors

Marco Villa
(at CERN, December 08)

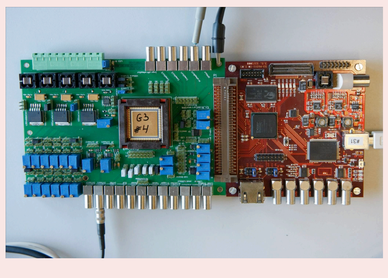
Front End Electronics for Hybrid Pixel Detectors

Francesco Zappon (at NIKHEF, June 09)



Italy (27/10/1983)
PhD St. at University of Amsterdam

Aim of the Project:
ATLAS/LHCb gaseous detectors upgrade.
My work:
✧ Design and test of the Gossipo3 chip
✧ Design of the Timepix2 chip



Training:
✧ Advanced digital design course
✧ C++ language course

Being a MC-PAD:
Possibility to do an experience in a foreign country, opportunities offered by the program (like training events) to take the best out of the PhD, financial conditions.

Future plans:
To apply for a PostDoc after the PhD, achieved also thanks to the MC-PAD.

Thomas Balog (at GSI, July 10)

Radiation Tolerant Mini-strip Tracking Detectors

Nicola Pacifico
(at CERN, January 09)

Advanced Photodetectors

Paolo Beltrame
(at CERN, April 09)

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Marie Curie for Particle Detectors

Marco Villa

Introducing myself
I am 27 years old and I come from Milan, Italy. In 2007 I obtained a master in Particle Physics at the University of Milan – Bicocca, defending a thesis on detector readout electronics. In 2008 I worked on the muon sub-detector of the LHCb experiment. Then, in December 2008 I started my Marie Curie fellowship at CERN as Early Stage Researcher in the MC-PAD Initial Training Network.

Attended trainings and conferences
- General and professional French courses, CERN (CH), January 2009
- Bad Honnef conference, Bad Honnef (D), March 2009
- 1st EIROforum School on Instrumentation, CERN (CH), May 2009
- MPGD2009 1st International Conference on Micro Pattern Gaseous Detectors, Creta (GR), June 2009
- 3rd RD51 Collaboration Meeting, Creta (GR), June 2009
- Eitorf conference, Eitorf (D), September 2009
- Communication courses on oral and poster presentations, CERN (CH), November 2009
- 12th Vienna Conference on Instrumentation, Vienna (A), February 2010
- Bad Honnef conference, Bad Honnef (D), March 2010
- C++ course, CERN (CH), March 2010
- 5th RD51 Collaboration Meeting, Freiburg (D), May 2010
- ESOF2010 EuroScience Open Forum, Turin (I), July 2010

The technical trainings helped me to deepen my knowledge of particle detectors, readout electronics, programming and data analysis. Thanks to language and communication courses I learned French and I improved my presentation skills. The many conferences I attended broadened my technical knowledge and actively involved me in a live research community.

Looking at the future
During my fellowship I will continue my PhD studies at the Bonn University and I will eventually defend my thesis. Afterwards, I'd like to continue my career in the field of detector Physics or applied Physics, covering the role of project manager.

Nicola Pacifico

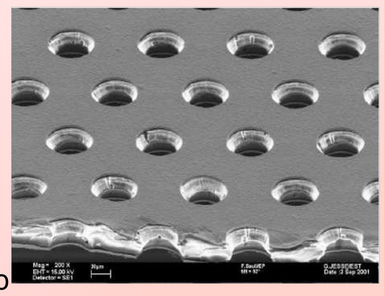
About me
I am 28 and I come from Bari, Italy. I took my master degree in physics at the University of Bari in 2008. After a short term appointment from my home university for working here at CERN, I started my Marie Curie in January 2009. I'm working on the Project 1 of the network, studying new technologies and materials for the next generation of silicon detectors, to be used for the upgrade of the LHC as well as for the FAIR (Facility for Antiproton and Ion Research) at GSI.

What is the Marie Curie giving me…
Being here at CERN is for sure the greatest opportunity at all. The biggest share in what I will gain from this experience will be for sure coming out from the people I'm having the pleasure to work with, from whose experience I will try to gain the most.
The Marie Curie network, enlarges even more this collaboration esprit, training me to team work and ideas sharing (this same poster session is already an example of this!).

… and the future
Nothing like a Marie Curie opportunity can develop your self-confidence and optimism for the future! Regardless of the details of my future adventures in the modern, fast-paced reality, I'm sure I will have developed the skills to face it in the most brilliant way.
My research activity constitutes the backbone of my PhD with the University of Bari.

Conference and events attended throughout my MC experience
- French courses (throughout the first year of research)
- EIRO Forum School on instrumentation, CERN
- 14th RD50 Workshop, Freiburg
- Alibava readout system training, University of Liverpool
- 15th RD50 Workshop, CERN
- LabVIEW course, CERN
- Training on communication skills and presentation techniques, CERN
- 16th RD50 Workshop, Barcelona

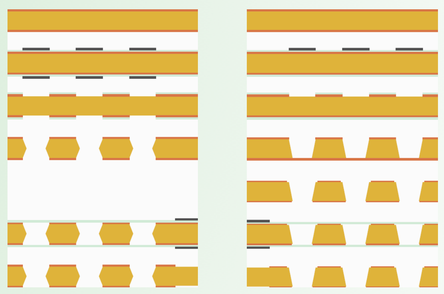
Detecting particles with GEMs - a short overview



- Gas Electron Multiplier (GEM): electron amplification structure invented at CERN in 1997
- GEM raw material: 50 μm thick polyimide foil covered with 5 μm copper on the two sides
- GEM manufacturing: by chemically etching tiny holes through the base material. The holes are about 60 μm in diameter and they are arranged in an hexagonally-packed pattern. The photo on the right shows a microscope picture of a GEM foil

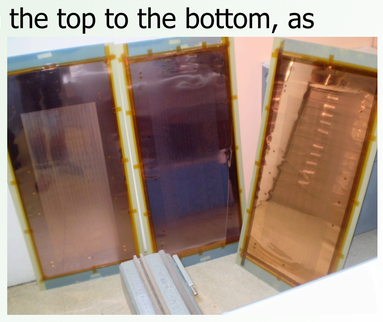
GEM-based detectors belong to the family of gas detectors, in which a gas mixture is used to detect particles. An ionizing radiation passing through the gas volume will deposit its energy, creating electron-ion pairs. An electric field in the gas volume will then separate charges of opposite sign, thus preventing them from recombining. The charge generated by ionization is however too small to be directly detected. Here GEMs come into play, amplifying the electron signal. Primary electrons created by ionization are focused into the GEM holes, where the strong electric field starts an avalanche multiplication process.

Dreaming of large area



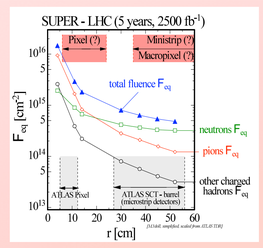
- GEM holes are etched through the raw material starting from patterns which are transferred from masks to the two GEM electrodes (picture on the left)
- Both the base material and the two masks are flexible, therefore the alignment procedure is far from trivial. When the GEM linear dimensions exceed ~30 cm this procedure is not feasible anymore
- Since GEM detectors find applications in many fields in which large area coverage is interesting, an R&D project has been started aimed at finding a GEM production technology scalable up to square meter size

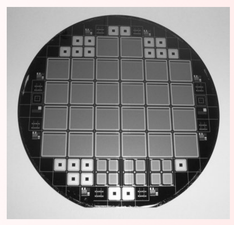
Single mask GEMs - path to performance
- Single mask GEMs are a new generation of GEMs which are produced using one mask only, thus completely removing the alignment issue
- Using this approach, GEM holes are etched layer by layer from the top to the bottom, as shown in the picture on the top right corner
- This technology has already been used to produce GEMs up to 30 x 70 cm (picture on the right)
- The detectors obtained from single mask GEMs have a performance compatible with the ones obtained from standard GEM
- Large scale production in collaboration with industry will eventually *decrease the price per unit area by two orders of magnitude*



My project:
Are our silicon detectors "hard" enough?

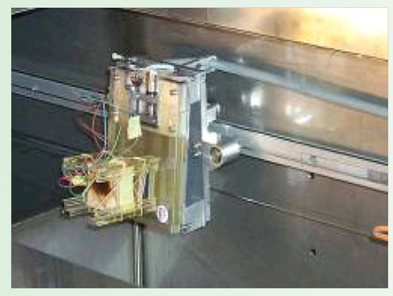
The next generation of LHC experiments, as well other colliders which are going to be built in the next decades, will expose silicon detectors to an extremely hard radiation environment.



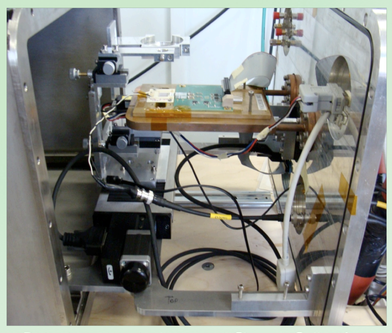


My project concerns the study of radiation damage on silicon detectors to be used in high energy particle colliders experiments and their future *upgrades*.
I'm mainly focusing on research on newly engineered silicon materials, characterizing them in order to find out the best candidate for the upgrade plans of future detectors.

Step 1: Damaging the detector
To simulate the damage produced by many years of operation, we "accelerate" the aging of the detector, by putting it directly on a proton or neutron or pion beam, reaching in a few days or weeks the radiation levels at which the detector is expected to be exposed after years of operation.



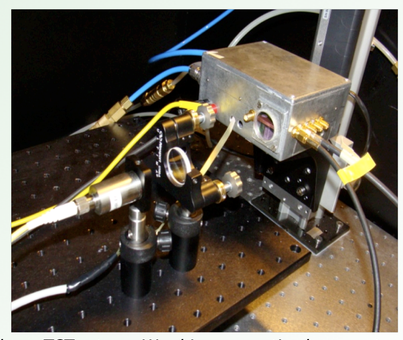
Some sensors just coming out from the PS proton beam… it was quite "hot" down there…



Detector mounted on our "Charge Collection Efficinecy" setup… ready to be measured

Step 2: Does it still work?
Will the detector work after some years of activity? This test bench will simulate the actual working conditions (cooling, events) inside a silicon tracker, revealing if the detector is still able to produce a detectible signal after having been heavily radiation damaged.

Step 3: What happened to the detector?
A complete understanding of the processes triggered inside the silicon by radiation damage is necessary to foresee its behavior in conditions that could be somewhat different from our specific case study. For this reason, we have developed as well microscopic studies techniques (TCT, Edge TCT), to work out what's actually happening in our detector and to be able to give information to particle physicists and engineers about how far they can push their detectors.



Edge – TCT setup… We shine a very tiny laser spot on the side the… edge of the detector. This will give us a complete information about how the detector behaves in every single point of it…

TRAINING FOR EUROPE
13-17 SEPTEMBER 2010

This research project has been supported by a Marie Curie Initial Training Network Fellowship of the European Community's Seventh Framework Program under contract number (214560 MC-PAD)

Marie Curie for Particle Detectors

Name: **Mary Tsagri** Age: 24 Origin: Corinth, Greece

Education:
- ✓ Degree in Physics 2008, University of Patras
- ✓ Summer Student at CERN & Max-Planck-Institut für Plasmaphysik (IPP), 2008
- ➢ PhD student @ UvA

Fellowship started: December 2008

Project: Optimization of Monte Carlo Tools and Comparison with Benchmark Data

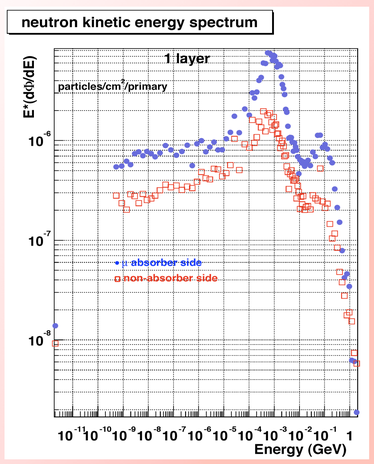
Attended trainings and meetings:

- École Geant4, Annecy, France, November 2008
- General and Professional French Courses
- 8th Fluka Course, Demokritos, Athens, Greece, March 2009
- Topical lectures on SUSY models, Nikhef, Amsterdam, December 2009
- C++ Part 1 - Hands-On Introduction, CERN, October 2009
- C++ Part 2 - Object-Oriented & Generic Programming, CERN, November 2009

* * *

- MC-PAD kick-off event at CERN, January 2009
- 1st EIROforum School on Instrumentation, CERN, May 2009
- 6th Geant4 Space User's Workshop, Madrid, Spain, May 2009
- RD51 mini week at CERN, February 2010

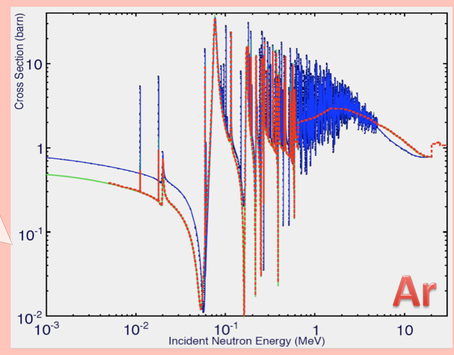
Validation of neutron cross sections aiming to improve the performance and reliability of Geant4

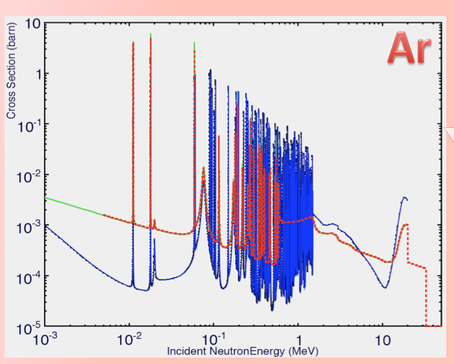


Geant4 simulations have been compared with established databases for neutron energies up to 20 MeV. These are the energies most relevant to the physical background in LHC and sLHC experiments. More specifically, such neutrons have impact on the performance of gaseous detectors; their interaction with the active gas cannot be always recognized by the very early trigger definition, contributing thus to the general background of the experiment.

Geant 4

Elastic Cross Section of neutrons in Argon. Agreement between G4, JEFF-3.0 & JEF-2.2. Large discrepancies between the recent libraries ENDF/B-VII.0 & JEFF-3.1 which coincide.



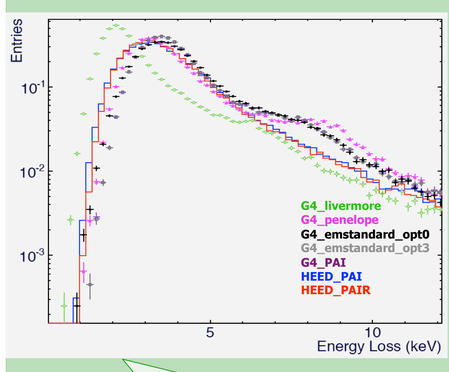


Radiative Capture Cross Section of neutrons in Argon. G4 overlaps with JEFF-3.0 & JEF-2.2. Differences with the new libraries ENDF/B-VII.0 & JEFF-3.1 which overlap.

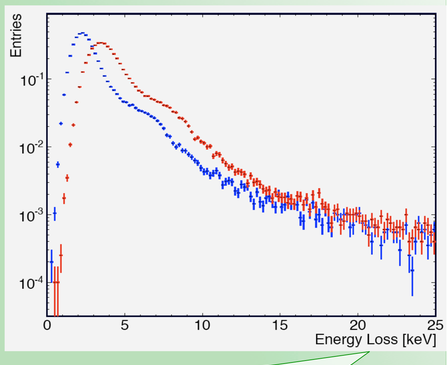
Results are available also for: Carbon, Helium, Hydrogen, Krypton, Oxygen and Xenon. Geant4 follows JEF-2.2 library for most elements. Moreover, neutron cross sections from recent libraries are being prepared.

Validation of Low Energy EM Physics Models for mips in gaseous detectors (Geant4, HEED & FLUKA)

EM physics models in Geant4 code, do not emit secondary e^- / γ below a set threshold whose range falls typically to ~1keV. When particles reach these energies, they are being absorbed locally. Low energy EM physics models in Geant4 and codes like HEED follow low-energy particles like e^-, γ, etc, taking into account atomic / molecular quantum effects, e.g., inner shell ionization, emission of Auger e^- and fluorescence γ, etc. When such details are included, the overall simulation is improved.

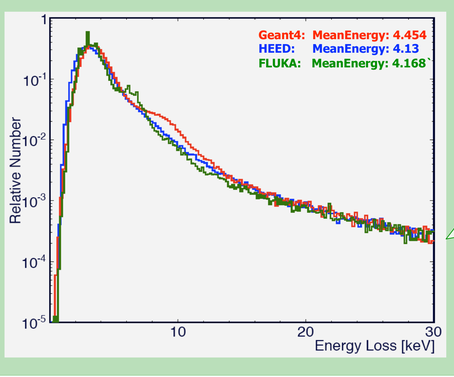


The comparison between Geant4 and HEED showed that the overall shape of the ionization loss spectra is in good agreement. A shoulder was found in Geant4 results and is being investigated. In addition, the simulation showed that Livermore model should not be used in the energy range 1MeV - 5GeV, due to lack of data.



e^-: 500 MeV/c. 1.5 cm of $Ar:CO_2$ [80:20]

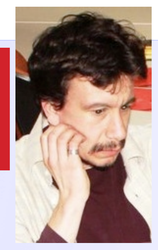
Mips: e^- & μ^- / 500 MeV/c in pure Argon.



A preliminary comparison between Geant4, HEED and FLUKA* codes is shown on the left. The general features are rather similar. This makes the source identification of the "shoulder" mandatory. The ultimate answer of this result will be given by experiment (e.g., beam data taking with a micromegas detector with appropriate thickness and good energy resolution (~20%) in a high energy beam).

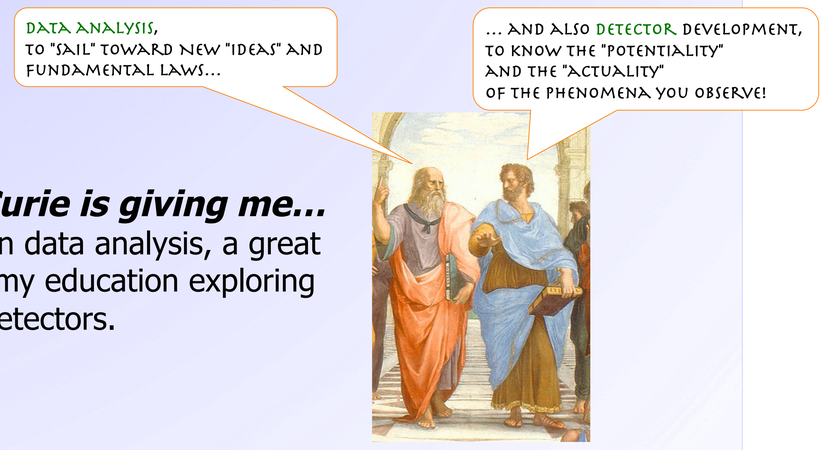
*by G. Tsiledakis / Saclay

Paolo Beltrame



About me

- ✓ Italian (from Rome) 33 years old
- ✧ Degree in **Philosophy**, at Pontifical University (2000) discussing the thesis on Christian Existentialism
- ✧ Degree in **Particle Physics**, at University of Rome La Sapienza (2004) performing high precision measurement on Kaon Physics
- ✧ PhD in **Particle Physics**, at University of Karlsruhe (2009) performing high precision measurement on hadron production from electron-positron collision
- ✧ Marie Curie PostDoc since April 2009



What the Marie Curie is giving me...

After having worked on data analysis, a great possibility to improve my education exploring the world of particle detectors.

... and the future

Keep walking on the way of fundamental particle physics research, enriching my next data analysis work with a wider understanding of the challenge arising from the detectors

A sort of synthesis between Plato and Aristotle in particle physics

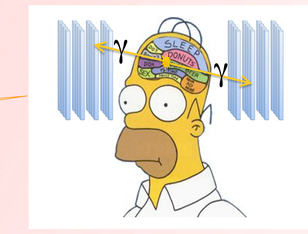
Training, courses, conferences and meetings *(only the most relevant)*

- ✧ French language courses
- ✧ Basic and advanced Programming language courses (C++, LabView)
- ✧ 1st EIROforum School on Instrumentation at CERN (May 2009)
- ✧ Communication and oral presentation workshop at CERN (November 2009)
- ✧ 12th Vienna Conference on Instrumentation in Vienna (February 2010)
- ✧ ESOF2010 EuroScience Open Forum in Turin (July 2010)
- ✧ Axial PET collaboration meetings
- ✧ ALFA ATLAS collaboration meetings

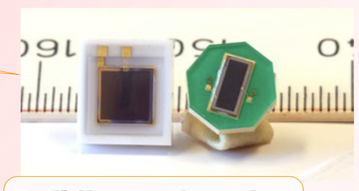
Axial PET: a novel concept for a Positron Emission Tomography camera

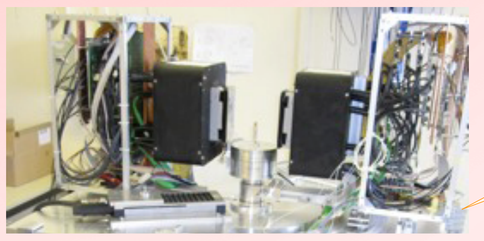
- ✧ Free of parallax error PET
- ✧ High sensitivity and high resolutions

Clever ideas: axially arranged crystals



State of the art Silicon Photodetectors

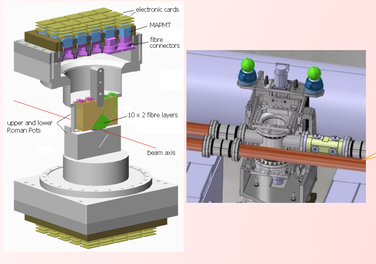




Building and testing new demonstrator

ALFA-ATLAS: measuring absolute luminosity with scintillating fibers

- ✧ Measurement of LHC luminosity
- ✧ Roman pot station at 240 m far away from the ATLAS detector



Test beams to prove the performances (in 2009 and 2010)

Feasibility studies on possible detector upgrades reading out scintillating fibers with Silicon Photomultipliers

An Unended Quest
(K.R. Popper)

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