Curriculum Vitae

Personal

Name	Erika Garutti
Born	June 22nd, 1974 in Alfonsine, Ravenna
Address	Ostermeyerstr 23, 22607 Hamburg, Germany
E-Mail	`erika.garutti@desy.de`
Nationality	Italian
Civil status	unmarried

Education

1988-1993	scientific college, "A. Roiti" (Ferrara, Italy) school leaving examination with mark 54 over 60.
1993-1997	Ferrara University (Ferrara, Italy), physics.
Dec. 1997	degree in physics with particle physics subject with mark 110 *cum laude* over 110.
1998-1999	Master at the Ferrara University (Italian master is equivalent to one year specialization, after graduation).
1999-2003	PhD in high energy physics at NIKHEF (Nationaal Instituut voor Kernfysica en Hoge-Energiefysica), Amsterdam, The Netherlands.
2003-2006	Post-doctoral Fellowship at DESY Hamburg.
since 2006	Permanent staff scientist at DESY.
2006-2011	Leader of a Helmholtz-Gemeinschaft Young Investigator Group (VH-NG-206) with the topic title "R&D studies of new Silicon-based Photodetectors and their integration to HEP and medical physics".

Research Projects

Medical field	R&D for a detector for Positron Emission Tomography	ongoing
Linear Collider	R&D for a hadron calorimeter	ongoing
H1	NLO calculation for heavy flavor analysis	'03-'05
HERMES	Analysis of heavy nuclei data	'00-'03
	Test and commissioning of silicon detector	'99-'00
	Hardware and simulations studies on polarized target	'98-'99
LHC	Design and simulation of a new superconducting dipole-multiple	'97

Teaching

2006-now	Supervision of several PhD and diploma students in my HGF group.
	Supervision of summer student programs.
	Lecturer at the Heidelberg Graduate Days.
	Invited talks in seminars at various universities (Bonn, Chicago, Shinshu).
2003-2006	Supervision of several PhD and diploma students in the FLC group.
	Supervision of laboratory experience for school and university students.
2002-2003	Supervision of a diploma student at NIKHEF
	Invited talks in students seminars for PhD and undergraduate students.

Skills

Languages	Italian (mother tongue), English (fluent), German (basic);
Computer	OS's: Linux (user), Windows (user), VMS (user)
	Languages: Fortran, C/C++, HTML
	Data analysis: PAW, ROOT
	else: MAPLE, LaTeX, Office Packages

Research Projects

HGF: Detector development Positron Emission Tomography

The Helmholtz-Gemeinschaft deutscher Forschungszentren (HGF) supports young scientists in their research via five years long grants which allow to establish a Young Investigator Group (Nachwuchsgruppe). In year 2006 I have received a grant to support my research interests in the field of "R&D studies of new Silicon-based Photodetectors and their integration to HEP and medical physics". This grant covers the positions of two post-doctorates and four PhD students, and in addition gives some flexibility for yearly investments. The group based at DESY links to the universities of Hamburg and Heidelberg in Germany, and Shinshu in Japan. In addition in year 2007 I have obtained from HGF an additional special grant for investments. This allowed me to start a significant laboratory activity contributing and complementing the already existing DESY infrastructure.

The most recent of my R&D activities is the development of a PET (Positron Emission Tomography) detector. Based on the expertise in calorimetry and in the operation and integration of Silicon-Photomultipliers, I have initiated within my group a series of activities to apply our technology to the medical field. A small prototype of PET detector has been developed in collaboration with the university of Heidelberg and is currently under test. The technological improvement is in the use of extremely small crystals (LSO or LFS, $3{\times}3{\times}15$ mm^3 in size) directly coupled to a Silicon-Photomultipliers. Each photodetector is individually readout, signal amplitude and timing are recorded. With this system a very competing energy resolution of 11% for 511 keV photons was obtained. The reached time resolution of 450 ps is very promissing and can be further improved using dedicated readout electronics. A new chip for this purpose has been designed by the Heidelberg partners of my group and will be soon tested with our system.

A larger scale project in the medical field is the realization of an endoscopic PET with ToF information combined with an ultra-sound probe. The main clinical objective is to address image-guided diagnosis and minimally invasive surgery with a miniaturized bimodal endoscopic probe with a millimeter spatial resolution and a 100 times higher sensitivity than whole-body PET scanners. This is the theme of a FP7-health proposal which I have submitted together with several universities (among which the university of Heidelberg), institutes (including CERN) and small-medium enterprises. The proposal will be evaluated by the EU commission and may be approved during 2010. In this case, my group will be involved for the coming four years in the development, commissioning and clinical test of an endoscopic PET system, and will have the responsibility for electronics design and mechanic integration. I shall be the coordinator of the related work package.

FLC: R&D for an hadron calorimeter

The physics program at the future ILC requires high precision for the reconstruction of heavy bosons (W, Z, H) in hadronic final states. The goal lies in a measurement of jets with an energy resolution of $30\%/\sqrt{E}$ or better. This can be achieved by combining the potentials of the particle flow approach with high granularity in transverse and longitudinal directions for

both electromagnetic and hadronic (HCAL) calorimeters.

The FLC group is involved in the development of an analog option for the HCAL based on a sampling structure with scintillating tiles read out by wavelength-shifting fibers coupled to different photodetectors. A small prototype was built in order to test the performance of a ∼100-channel device in a test beam, studying uniformity, stability, performance of different photodetectors, system calibration, monitoring and MC simulation of the shower development. Based on the success of the first prototype a larger detector for hadronic shower physics studies has been built which consists of ∼8000-channels individually read out via Silicon-Photomultipliers.

For the first prototype I have contributed to the setup and maintenance of the test beam data acquisition and to the complete set of measurements performed in the test beam with various photodetectors readout. I have actively participated into the analysis of the test beam results. This work terminated in Oct. 04 and is presented in two publication and two LC notes. The project continued with the construction of a larger prototype. In this second phase I was involved in the test and development of the electronic readout system and data acquisition as well as test and analysis of the calorimeter performance. The calorimeter R&D project is a multi-group effort which requires close communication with external groups from Russia, France, Czech Republic, United States and Japan, as well as close contact with electronic engineers and technicians. I have worked closely with the other groups trying to collaborate in the communication and coordination between them. I was invited as external expert to participate for one month to the test beam activities in Japan, where I have worked at the setup and test of an electromagnetic and a hadronic calorimeter prototype.
Subsequently, I have coordinated for the CALICE collaboration two test beam campaigns at CERN in year 2006 and 2007. I was responsible for the integration, commissioning and operation of various calorimeters as well as the beam line instrumentation. I have coordinated the run plan and the data collection and I was responsible for organization of shifts and shift training for an experiment to which about 80 people took part.
In 2008 I plaid a similar run coordination role for the FNAL test beam campaign but mainly based in the remote DESY control room in Hamburg. I have contributed to establish the remote operation of the detector as well as remote shifts.
I have been and still am responsible for the supervision of several students in the FLC group as well as in my HGF Young Investigator Group. I am directly following every part of data analysis, from calibration of the detectors, beam diagnostics, alignment and trigger studies, to electromagnetic and hadronic shower studies, MonteCarlo models validation and particle flow studies.
In the framework of my HGF Young Investigator Group I have equipped a laboratory setup for tests of silicon-based photodetectors (Silicon-Photomultipliers) and initiated several studies for alternative and improved solutions for the hadronic calorimeter design. New materials, new photodetectors and improved coupling between them are being investigated. Both scintillation and Cerenkov light readout systems are developed and tested in my group, with the goal of finding new and interesting solutions for future, more demanding experiments like at the CLIC accelerator or for astroparticle physics applications.

H1: NLO calculation for heavy flavor analysis

Calculations in perturbative quantum chromodynamics (pQCD) are expected to give reliable predictions of heavy flavor processes, for example $ep \rightarrow eb\bar{b}X$ as the mass m_b of the b-quark ($m_b \sim 5$ GeV) provides a hard scale. First beauty cross section measurements at HERA were higher than theoretical predictions in pQCD performed to next-to-leading order (NLO). These observations were confirmed by other experiments, but more recent analysis presented by ZEUS and H1 shows agreement with QCD predictions within experimental uncertainties.

Measurements of total and differential beauty production cross sections are performed from B-hadrons decaying into muons. Both the large mass and the long lifetime of the B-hadrons are combined to select beauty from charm or light quarks events. For the majority of events in the kinematic region $2 < Q^2 < 100$ the transverse momentum of the outgoing b-quark is $> m_b$. In this region, NLO calculations in the massive scheme are expected to give reliable results. In this scheme u, d and s are the only active flavors in the proton, and charm and beauty are produced dynamically in the hard scattering.

I have performed NLO QCD calculations for DIS cross sections using . The calculations compared to the data analysis are presented in an internal note and proposed for a publication.

HERMES: First observation of the Scalar Meson f0(980) in DIS

The production of the $f_0(980)$ scalar meson in deep inelastic positron scattering has been investigated. The interpretations for the $f_0(980)$ meson include several non-$q\bar{q}$ objects: multi-quark hybrid, mixed glueball, and vacuum scalar, or $K\bar{K}$ molecule states.

The measurements were performed on a hydrogen unpolarized target. The f_0 is identified through its decay $f_0 \rightarrow \pi^+\pi^-$. The significance of the signal in this channel is above 4 standard deviations. The position and width of the observed $f_0(980)$ peak agree with those reported by other recent measurements. The dependence of $f_0(980)$ electro-production on several kinematic variables is reproduced by Monte Carlo simulations where the dominant production mechanism for hadrons is assumed to be fragmentation into $u\bar{u} + d\bar{d}$ pairs.

I have performed this analysis as a part of my PhD thesis, which also comprises the two analysis described below. The results are summarized in a proceeding to the DIS2003 conference and the analysis is still under investigation at HERMES for final publication.

Hadron Formation in Nuclei in DIS

Deep-inelastic scattering offers a direct way of studying the space-time development of the hadronization (or fragmentation) process, which is the process by which final-state hadrons are formed from the quark struck in a hard scattering event. The hadron formation time can be determined by measuring the effect of secondary reactions of the final state particles in the nuclear medium.

By measuring the multiplicity of hadrons produced on a heavy nucleus as compared to that on deuterium, the effect of the secondary interactions is observed as an attenuation of the

hadron multiplicity. A large reduction of the differential multiplicity of charged hadrons from nitrogen, and even stronger from krypton, relative to that from deuterium is observed. The multiplicity ratio has been evaluated separately for charged pions, kaons and protons in order to better understand the hadronization process distinguishing from various theoretical models.

As a result of this analysis considerations on the formation times of various hadrons were possible. The data indicate similar formation times for pions and kaons, while the proton formation time appears to be about twice as long as that of pions. This work is reported in one publication (article 8) and was presented by me in three conferences.

Inclusive cross section ratio σ_A/σ_D on He, N, and Kr targets

In deep inelastic scattering of leptons from nuclei the structure of the nucleon is described by two structure functions $F_2(x, Q^2)$ and $R(x, Q^2)$. It is well known since many years that when embedded in the nuclear medium $F_2(x, Q^2)$ is different from the one measured on the free nucleon. The possible nuclear effects on $R(x, Q^2)$, the ratio of the longitudinal to transverse DIS cross sections, have been the subject of investigation at HERMES.

I have performed the analysis of krypton data to cross check previous HERMES observations of A-dependence of $R(x, Q^2)$ on a nitrogen data sample. These analysis led to the conclusion that the previously observed dependence was caused by an instrumental effect. In fact, by combining the newly analyzed HERMES data on inclusive DIS off nuclei with existing NMC data on neighboring nuclei it is found that $R_A \approx R_D$ down to $Q^2 = 0.5$ GeV^2. The analysis culminated in the publication of an erratum to the previous analysis and a publication describing the new results (articles 5 and 6).

Test and commissioning of silicon detector

During the year 2001 a new detector has been installed in the front region of the HERMES spectrometer as part of a general upgrade project. A wheel-shaped array of silicon counters was placed right after the target chamber and before the standard tracking detectors. The aim is to increase the detector acceptance and in particular to augment by a factor of four the yield of reconstructed Λ-hyperons to obtain additional and qualitatively new information on the spin structure of the nucleon and some other baryons.

I participated in the test and operation of a single module prototype started at the beginning of 2000. I have been responsible for the cooling system of the detector and took part in the setup of the detector readout system. I had on-call responsibility over the first year of integration of the prototype into the HERMES spectrometer.

Results of the tests performed on the module prototype are reported in a NIM publication (article 7).

Activities in the target group

The Ferrara group is responsible for a significant portion of the HERMES target (magnet cryogenic system, target cell, target chamber, and electronics). During the year I worked

as Research Assistant for Ferrara University at DESY I learned about the operation and monitoring of a polarized gaseous target. I was on-call responsible for the cryogenic system of the superconductive target coil needed to preserve the polarization state of the gas once injected. In addition, I was involved with Monte Carlo simulations of the dynamics and performance of the target.

LHC: Feasibility study of a superconductive corrector coil

For my diploma thesis I worked closely with LHC design staff on the design and simulation of a new superconducting dipole-multiple integrated magnet system. This system was demonstrated to improve achromatic steering and was chosen as a component of the LHC lattice.

This research culminated in a diploma thesis in accelerator physics at the Ferrara University.

List of Publications

Most relevant publications:

1. Study of Micro Pixel Photon Counter for the Application to Positron Emission Tomography. N. D'Ascenzo, (Hamburg U. & DESY), E. Garutti, M. Goettlich, (DESY), H.C. Schultz-Coulon, A. Tadday, (Heidelberg U.). DESY-08-047, May 2008. e-Print: arXiv:0805.0525.

2. Dedicated very front-end electronics for an ILC prototype hadronic calorimeter with SiPM readout. S. Blin et al. LC-DET-2006-007, CERN-2008-008, 2006. Published in "Naxos 2008, Electronics for particle physics" 97-106.

3. Application of the Micro Pixel Photon Counter to calorimetry and PET. N. D'Ascenzo (Hamburg U. & DESY), A. Eggemann, E. Garutti (DESY), A. Tadday (Heidelberg U.). Published in Nuovo Cim.30C:463-472,2007.

4. Fast and reasonable Installation, Experience and Acceptance of a Remote Control Room. R. Eisberg, E. Garutti, R. Kammering, A. Kaplan, S. Karstensen, B. Lutz, N. Meyer (DESY), R. Poschl (Orsay, LAL), B. Warmbein (DESY). e-Print: arXiv:0811.3228.

5. Study of micro pixel photon counters for a high granularity scintillator-based hadron calorimeter. N. D'Ascenzo, (Hamburg U. & DESY) , A. Eggemann, E. Garutti, (DESY). DESY-07-196, Nov 2007. e-Print: arXiv:0711.1287.

6. Application of MPPC to positron emission tomography. N. D'Ascenzo, (Hamburg U. & DESY), E. Garutti, (DESY), A. Tadday, (Heidelberg U.). Published in PoS PD07:006,2006.

7. Nuclear Effects in Semi-Inclusive Deep-Inelastic Scattering off ^{84}Kr and other nuclei
   By Erika Garutti (Amsterdam U.). DESY-HERMES-03-02, Mar 2003. Ph.D. Thesis (Advisor: G. van der Steenhoven).

Publications with the CALICE collaboration:

8. Response of the CALICE Si-W electromagnetic calorimeter physics prototype to electrons. C. Adloff et al. Published in Nucl.Instrum.Meth.A608:372-383,2009.

9. CALICE scintillator HCAL - electromagnetic and hadronic shower analysis. By CALICE Collaboration (Erika Garutti for the collaboration). Published in J.Phys.Conf.Ser.160:012077,20

10. Response of the CALICE Si-W Electromagnetic Calorimeter Physics Prototype to Electrons. By CALICE Collaboration (C. Adloff et al.). Published in J.Phys.Conf.Ser.160:012065,2009.

11. Design and Electronics Commissioning of the Physics Prototype of a Si-W Electromagnetic Calorimeter for the International Linear Collider. By CALICE Collaboration (J. Repond et al.). Published in JINST 3:P08001,2008.

12. Summary of the 2007 CALICE test beam at CERN. By CALICE Collaboration (E. Garutti et al.). CERN-SPSC-SR-023, CERN-SPSC-2007-027, Sep 2007.

13. CALICE Report to the Calorimeter R&D Review Panel. By CALICE Collaboration (C. Adloff et al.). ILC-DET-2007-024, Jul 2007. e-Print: arXiv:0707.1245.

14. CALICE scintillator HCAL commissioning experience and test beam program. E. Garutti, (DESY). Prepared for 12th International Conference on Calorimetry in High Energy Physics (CALOR 06), Chicago, Illinois, 5-9 Jun 2006. Published in AIP Conf.Proc.867:574-581,2006.

15. Calibration and Monitoring of the Analog HCAL Prototype. E. Garutti, (DESY) . LCWS-2005-0917, Mar 2005. In the Proceedings of 2005 International Linear Collider Workshop (LCWS 2005), Stanford, California, 18-22 Mar 2005.

16. A high-granularity plastic scintillator tile hadronic calorimeter with APD readout for a linear collider detector. V. Andreev et al. DESY-05-143, Oct 2005. Published in Nucl.Instrum.Meth.A564:144-154,2006.

17. Status report on silicon photomultiplier development and its applications. By Calice/SiPM Collaboration (B. Dolgoshein et al.). 2006. Published in Nucl.Instrum.Meth.A563:368-376,2006.

18. A High-Granularity Scintillator Calorimeter Read Out with Silicon Photomultipliers V. Andreev et al.. DESY-04-143, LC-DET-2004-027, Oct 2004.

ILC related publications:

19. ILC Reference Design Report Volume 4 - Detectors. By ILC Collaboration (Ties Behnke, (Ed.) et al.). Dec 2007. e-Print: arXiv:0712.2356.

20. ILC Reference Design Report: ILC Global Design Effort and World Wide Study. By ILC Collaboration (James Brau, (Ed.) et al.). Aug 2007. e-Print: arXiv:0712.1950.

21. International Linear Collider Reference Design Report Volume 2: PHYSICS AT THE ILC. By ILC (Gerald Aarons et al.). Sep 2007. e-Print: arXiv:0709.1893.

Coauthor of 36 publications of the H1 collaboration among which direct contribution to:

22. Measurement of beauty production at HERA using events with muons and jets. By H1 Collaboration (A. Aktas et al.). DESY-05-004, Feb 2005. Published in Eur.Phys.J.C41:453-467,2005.

Coauthor of 26 publications of the HERMES collaboration among which direct contribution to:

23. Transverse Polarization of Lambda and anti-Lambda Hyperons in Quasireal Photoproduction. By HERMES Collaboration (A. Airapetian et al.). DESY-07-036, Apr 2007. Published in Phys.Rev.D76:092008,2007.

24. Electro-production of f0(980) scalar mesons at HERMES. By HERMES Collaboration (Erika Garutti for the collaboration). Apr 2003. Published in "St. Petersburg 2003, DIS 2003" 608-612.

25. Nuclear Polarization of Molecular Hydrogen Recombined on a Non-metallic Surface. By HERMES Collaboration (A. Airapetian et al.). DESY-03-168, Oct 2003.

26. Quark Fragmentation to $\pi^{+/-}$, π_0, $K^{+/-}$, p and pbar in the Nuclear Environment Published in Phys.Lett.B577:37-46,2003.

27. The storage cell of the polarized H/D internal gas target of the HERMES experiment at HERA
C. Baumgarten et al.. 2003. Published in Nucl. Instrum. Meth. A496:277-285,2003

28. Hadron formation in nuclei in deep-inelastic scattering lepton scattering. By HERMES Collaboration (E. Garutti for the collaboration). Mar 2002. Prepared for 9th International Conference on the Structure of Baryons (Baryons 2002), Newport News, Virginia, 3-8 Mar 2002.

29. Hadron formation in nuclei in DIS. By HERMES Collaboration (E. Garutti for the collaboration). 2002. Prepared for 10th International Workshop on Deep Inelastic Scattering (DIS2002), Cracow, Poland, 30 Apr - 4 May 2002. Published in Acta Phys.Polon.B33:3013-3017,2002.

30. Measurement of R = sigma(L) / sigma(T) in deep inelastic scattering on nuclei. By HERMES Collaboration (A. Airapetian et al.). DESY-02-091, Oct 2002. e-Print: hep-ex/0210068

31. Erratum to K. Ackerstaff et al, Phys. Lett. B 475 (2000) 386
By HERMES Collaboration (A. Airapetian et al.). Phys. Lett.B 567 (2003) 339.

32. Multiplicity of Charged and Neutral Pions in Deep-inelastic Scattering of 27.5 GeV Positrons
Published in Eur.Phys.J.C21:599-606,2001.

33. Hadron formation in deep inelastic positron scattering in a nuclear environment. By HERMES Collaboration (A. Airapetian et al.). DESY-00-191, Dec 2000. Published in Eur.Phys.J.C20:479-486,2001.

Additional proceedings and notes:

1. Time based readout of a silicon photomultiplier (SiPM) for Time Of Flight Positron Emission Tomography (TOF-PET), P. Jarron, E. Auffray, S.E. Brunner, M. Despeisse, E. Garutti, M. Gttlich, H. Hillemanns, P. Lecoq, T. Meyer, F. Powolny, W. Shen, H.C. Schultz-Coulon, M.C.S. Williams, Symposium IEEE 2009, October 2009, Orlando, USA.

2. Application of Silicon Photomultipliers to calorimetry and to Positron Emission Tomography, E. Garutti, M. Goettlich, H.-C. Schultz-Coulon, A. Tadday International Workshop on New Photon Detectors (PD09), Shinshu, Japan Proceedings of Science, pos.sissa.it, 2009.

3. Application of Multi-Pixel Photon Counter to Positron Emission Tomography M. Gttlich, E. Garutti, V. Kozlov, H.-C. Schultz-Coulon, A. Tadday, A. Terkulov Nuclear Science Symposium and Medical Imaging Conference (IEEE 2008), Dresden, Germany, 19-25 Oct 2008.

4. Application of novel Silicon Based photo-detector to calorimetry and medical physics, E. Garutti, N. D'Ascenzo, Nuclear Science Symposium and Medical Imaging Conference (IEEE 2007), Honolulu, USA, 31 Oct - 3 Nov 2007.

5. Application of MPPC to Positron Emission Tomography, N. D'Ascenzo, E. Garutti, A. Tadday, International Workshop on New Photon Detectors (PD07), Kobe, Japan, Proceedings of Science, pos.sissa.it, 2007.

6. Magnetic Field Dependence Studies for Silicon Photomultiplier
   By E. Garutti, M. Groll, A. Karakash, S. Reiche (DESY & Hamburg U. & Moscow Phys. Eng. Inst.), LC-DET-2004-025, 2004.

7. Results from the First Tile-HCAL Prototype
   By E. Garutti (DESY),. LC-DET-2004-021, Apr 2004.

8. HERMES Results on Nuclear Effects in DIS
   By HERMES Collaboration (E. Garutti for the collaboration). 2002. Prepared for Workshop on Low x Physics, Antwerp, Belgium, Sept. 16-19, 2002 .

9. Measurement of Beauty Production in Deep Inelastic Scattering at HERA
   O. Behnke, T. Lux, A. Meyer, E. Garutti, H1prelim-04-071.

10. Nuclear attenuation of fast electroproduced pions, kaons and anti-protons in kypton
    N. Bianchi, P. Di Nezza, E. Garutti, V. Muccifora, HERMES internal report.

11. Semi-Inclusive Electroproduction of f0(980) Scalar Mesons
    M. Tytgat, E. Garutti, HERMES internal note.

12. nu-dependence of f0(980)
    M. Tytgat, E. Garutti, HERMES internal note.

13. DIS Cross-Section Ratio for 84Kr/2H
    B. Fox, E. Garutti, HERMES internal note.

Seminars and lectures:

1. XXIII Heidelberg Physics Graduate Days, Uni. Heidelberg, 5-9 October 2009. “the art of Calorimetry”.

2. Uni. Chicago seminar, Chicago, May 2008, “Calorimeters at the ILC”.

3. Uni. Bonn seminar, Bonn, 14 Dec. 2006, ”Silicon-photomultiplier technology and their application in a calorimeter for the ILC”.

4. DESY seminar, Hamnurg, 22 Nov. 2006, ”Silicon-photomultiplier technology and their application in high energy physics detectors”.