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Curriculum Vitæ

Name	Marco Pullia
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Marital status	
Present position	Staff researcher at Fondazione CNAO Via Caminadella, 16 20123 MILANO Tel: +39 – 0382 – 078 468 (Office) Tel: +39 – 0382 – 078 276 (Ctrl room) Tel: +39 – 329 – 67 35 508 (Cell) Tel: E-MAIL: marco.pullia@cnao.it

Academic History and Qualifications

Qualification attained	PhD with Honours
University	Université Claude Bernard - Lyon 1
Thesis subject	'Dynamics of slow extraction and its influence on transfer line design'
Supervisor	Prof. J. E. Augustin
Referees	P.J. Bryant (CERN) P. Lefevre (CERN) C. Steinbach (CERN)
Qualification attained	Laurea in Fisica 110/110 cum laude (with Honours)
University	Università degli studi di Milano Dipartimento di Fisica Via Celoria, 16
Final Year Thesis	'New techniques for acceleration: CLIC and ELFA'
Supervisors	Prof. U. Amaldi Prof. R. Bonifacio Prof. I. Boscolo

Languages

Italian	Mother Language
English	Very Good
French	Very Good
Spanish	Good

Computer experience

I have a good knowledge of C, FORTRAN and BASIC and some experience of PASCAL, LABVIEW, HTML, JAVASCRIPT and NODAL. I have made simulation programs both in FORTRAN, in C and in VISUAL BASIC. In particular, I made programs to simulate: backward and forward transition radiation, the electromagnetic scattering through a thin foil, slow extraction from a synchrotron, beam transport and beam analysis.

I have a good knowledge of common programs like

- MAD
- Mathematica
- Excel
- Word
- Mathcad

Referees

The following persons can be contacted as referees

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Employment History and Job Descriptions

July 1988 - September 1988.

During this period, I was a Summer Student at CERN. The subject of my work was the set-up of an instrument to automatically measure the critical temperature of superconducting samples. The instrument is based on the Meissner effect. The control system, the data acquisition and analysis is made with a Hewlett-Packard PC connected to a digital voltmeter.

My original contribution to this job has been the assembly of the system, the software development and the measurement of some samples (Nb).

September 1989 – March 1990.

During this period I was at CERN for the “external” part of my diploma thesis. I have been working with I. Wilson and W. Wuensch on the CLIC accelerating structure. In particular I have made calculations with MAFIA for the main cell and for the RF power coupler to feed each module of accelerating structure. Moreover I have participated to the measurements of the first cells, of the first clamped and the first brazed sections. I have also participated to the tuning of the first module and to the matching of the RF coupler.

A second part of work has been made in Milano with the ELFA theory group after my stay at CERN. In Milano I have been studying the possibility of using the bunching capability of a FEL to generate the CLIC driving beam and the space charge debunching.

November 1992 - October 1993.

During this period, I had a grant from Digital Equipment Inc. to study, in collaboration with INFN, an “Interactive System for on-line Electron Beam Diagnostics”.

The work was carried out at the Milan INFN Section and consisted in the development of a method for position, size and emittance measurement of a charged particle beam, using a fluorescent screen and a CCD camera. Position and size measurements are made directly by transforming the image of the beam seen by the camera into real coordinates. The emittance is derived from the image widths generated by an array of parallel slits (mono-dimensional “pepper pot”). All these operations are performed by two interconnected PCs. The first one is dedicated to image acquisition, while the second is dedicated to data analysis.

The analysis software has been developed under LabView, to create an instrument that is simple to use with a good graphical presentation of the data.

Finally, the instrument has been tested on the tandem Van de Graaff beam in Catania.

During this period, I also worked on transition radiation. The aim was to show the feasibility of a device using a thin metallic foil as particle-radiation converter. These studies led to a general expression for the radiation emitted at the traversal of the boundary between two

media and led to the proposal for a group V INFN experiment (TRADE) to verify the theoretical expressions obtained.

December 1993 - February 1994

In this period, I worked as teacher in a Milan high school for the subject of “electrical plants”.

March 1994 - August 1995

In this period, besides teaching, I had a grant from “Fondazione per Adroterapia Oncologica”. The work was the study of suitable devices to monitor the beam in the high-energy transfer lines of the CNAO (National Centre for Oncological Hadrontherapy). As a consequence of this study I started to investigate the scattering of charged particles during the traversal of thin foils. The aim was to estimate the effect on the beam of thin-foil secondary emission monitors (SEM). Since the thickness of the foils considered was beyond the validity limits of the Highland formula, I wrote a small Monte Carlo code to simulate the scattering process.

In addition I studied with the program MAD (Methodical Accelerator Design) the linear optics of the transfer lines from the synchrotron to the patient.

Finally I made a study of the lines considering also the presence of the SEMs, which needed a combined use of MAD and of the scattering simulation.

September 1995 - October 1995

In September 1995, I left teaching and became staff member of “Fondazione per Adroterapia Oncologica”.

October 1995 - November 1999

In this period I have been working at CERN, in the Proton Ion Medical Machine Study (PIMMS) group, which was born from an agreement between CERN, GSI, MED-AUSTRON and TERA. The group was led by Phil Bryant and the aim was the design of a synchrotron dedicated to hadrontherapy. In this framework, I have been studying the third-integer resonance extraction both with an analytic approach and writing numerical simulation codes. This work led to an improved understanding of the time a particle is trapped in the resonance and of the transfer function of the resonance. This, in turn, led to the proposal for intrinsic smoothing that is one of the newer features in the PIMMS design.

I have also been studying the phase space distribution of the extracted beam, both analytically and with numerical simulations. The strong asymmetry between the horizontal and vertical phase plane, calls for a non-standard design of the transfer lines and gantry optics, which is also part of my work. The system proposed for the beam size control is original and there is no similar system currently working.

Finally I have been working on the revision of the synchrotron design and, in particular, on the RF cycles, multi-turn injection, aperture specifications, scraping and dumping.

In addition during this period I have participated to a few machine developments on the CERN PS and I have been working on the design, construction and software control of a beam monitor for the extraction line. The device monitors the halo of the beam and gives an alert if the beam moves out of the permitted range. Preliminary test of this monitor have been performed on a SPS extraction line, but the development of that monitor is not yet finished and further tests are foreseen on an extraction line of the AD.

December 1999 – September 2002

I have been working in the Milano Section of TERA on two main subjects:

- 1) the study of a pixel detector for quality control in radiotherapy in collaboration with INFN and Turin University
- 2) slow extraction studies on SIS at GSI (Germany)

The first subject was started a few years ago by INFN and Turin University and I have now joined their group. The subject I am working on at the moment is the revision of the signal acquisition board and the design of a couple of TTL - RS422 - TTL interface boards for remote control of the device.

About the second subject I am preparing a theoretical and experimental study of slow extraction at GSI with both the standard "quadrupole extraction" and the more recent "RF-KO extraction". In this framework I have been a few times in the control room to make slow extraction tests and measurements.

September 2002 – September 2003

I have been working to the "Final Design" of the *Centro Nazionale di Adroterapia (CNA)* in which I lead the Optics and Parameters Group. In this framework I have participated to the definition of all the specifications of all the parts of the machine.

September 2003 – August 2010

In this period I have taken part to the realisation of the *Centro Nazionale di Adroterapia Oncologica (CNAO)* in which I was responsible for the accelerators' design, parameters and operation. I have also been responsible for the magnetic measurements and acceptance. In these years I have led a group of 25 people and I have taken part to the installation of accelerators and transfer lines. I have also led the commissioning of the CNAO accelerators.

August 2010 – November 2011

In this period I was part of the accelerators group at CNAO where I took part to the commissioning and operation of the accelerators. I was in charge of the accelerators personnel organisation and of the budget management of the accelerator division.

November 2011 - Today

At present I am part of the accelerators group at CNAO where I take part to the commissioning and operation of the accelerators. I am also responsible of the R&D unit of the accelerator division.

Other relevant experiences

Starting with the academic year 2003-2004 I gave the accelerator physics lectures at the Milano-Bicocca University for 4 years.

In 2008-2009 I gave the accelerator physics lectures at the Pavia University for the PhD program.

In the academic years 2011-2012 and 2012-2013 I gave the accelerator physics lectures at the “Second level master in hadrontherapy” held at the Pavia University.

In April 2013 I gave a lecture on “accelerators for hadrontherapy” in the “Master course about Synchrotron” at ALBA/CELLS (Barcellona, Spain)

I give the accelerator physics lectures in the “Corso teorico-pratico sull’Adroterapia”, giving credits valid for the annual update of the medical personnel in Italy, organized by CNAO.

In June 2013 I gave the accelerator physics lectures in the “Cell Rad” course organized by the Pavia University.

I have made the military service as an officer. During this period I had to organise and I have been responsible of a company of about 200 men.

Other relevant notes

On 12th December 2000, I have received the “*Christoph Schmelzer Preis*” for the contribution given to hadrontherapy with my PhD thesis.

I was part of the Technical Advisor Committee of the Med-Austron Project (MATAC) since 2008, when it was established.

I was supervisor of one student in the PARTNER (Particle Training Network for European Radiotherapy) Marie Curie Training project.

In the period 2009-2012 I was leading the “gantry design” work-package in the ULICE European project.

In January 2013 I was part of the selected number of experts invited for the “Ion Beam Therapy Workshop”, in Bethesda MD, to promote hadrontherapy in the USA.

I was part of the Scientific Advisory Board of IPAC 2013

I was part of the Scientific Advisory Board of IPAC 2015