

ALLEGATO B

UNIVERSITÀ DEGLI STUDI DI MILANO

selezione pubblica per n.1 posto/i di Ricercatore a tempo determinato ai sensi dell'art.24, comma 3, lettera b) della Legge 240/2010, per il settore concorsuale 02/A1, settore scientifico-disciplinare FIS/01 - FIS/04, presso il Dipartimento di Fisica "Aldo Pontremoli"
(avviso bando pubblicato sulla G.U. n. 53 del 5 luglio 2019) Codice concorso 4131

Nicola Pozzobon CURRICULUM VITAE

INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

COGNOME	POZZOBON
NOME	NICOLA
DATA DI NASCITA	18 FEBBRAIO 1983

CURRENT POSITION: Fixed-term Staff Researcher according to art. 24/3/a, L. 240, Dec. 31, 2010
Ricercatore a Tempo Determinato ai sensi dell'art.24, comma3, lett.a, della legge n. 240, 31 Dicembre 2010
qualified as Associate Professor according to the National Academic Qualification, sector 02/A1 - Experimental Physics of Fundamental Interactions
- 5.12.2017 to 5.12.2023

HOME INSTITUTION: Dipartimento di Fisica e Astronomia "G. Galilei", Università degli Studi di Padova

HIGHLIGHTS

PUBLICATIONS (co-)author of 822 preprints and journal articles [inspirehep.net, July 11, 2019]
H-INDEX 134 (98 without self-citations) [inspirehep.net, July 11, 2019]
CITATIONS 82225 (49943 without self-citations) [inspirehep.net, July 11, 2019]
OUTSOURCING 1 invited oral, 9 oral, and 4 poster contributions to international or public conferences and workshops
PATENTS co-inventor of a method and device for the real-time pattern recognition, patent number IT102016000018895, granted 31st Oct. 2018, pending since 24th Feb. 2016
FUNDING beneficiary of 5 study grants and scholarships by Università degli Studi di Padova, Scuola Normale Superiore di Pisa, United States Particle Accelerator School and Fondazione "T. Tessari", and of 3 research grants and funding programs by MIUR, CERN and Fondazione "Ing. A. Gini"
COLLABORATIONS member of the CMS Collaboration since 2008 former member of the CDF Collaboration from 2004 to 2008 formerly active within the SOIPIX Consortium from 2008 to 2010
AREAS OF EXPERTISE high- p_T and flavour physics at hadron colliders detector response simulation and validation prompt data processing and trigger algorithms development and characterisation of silicon pixel detectors development of detector systems for medical proton Computed Tomography
RESPONSIBILITIES current coordinator of the simulation studies of the ERC-granted iMPACT project pCT scanner, of the optimization of its calorimeter readout

architecture and of prompt data analysis responsible within the CMS Collaboration of track trigger and DT trigger simulation studies and of the L1 DT trigger emulator
supervision and training of several students for both the CMS Experiment and the iMPACT project member of the local organising committee of three editions of the INFN detectors and electronics school in Legnaro

EDUCATION

- 16.3.2011 *Ph.D. in Physics*
Università degli Studi di Padova
A Level 1 Tracking Trigger for the CMS Experiment at the LHC Phase 2 Luminosity Upgrade [CERN-THESIS-2011-029]
- 21.9.2007 *Laurea Specialistica in Physical Sciences*
Università di Pisa, 110/110 laude Experimental Study of the WZ Intermediate Bosons Associated Production with the CDF Experiment at the Tevatron Collider [FERMILAB-MASTERS-2007-01]
- 29.7.2005 *Laurea in Physics*
Università di Pisa, 110/110 laude Methods for the Measurement of the Top Quark Mass [FERMILAB-BACHELORS-2005-03]
- 2002-2007 *Diploma di Licenza*
Scuola Normale Superiore (Pisa), 70/70 laude
- 1997-2002 *Esame di Stato (Liceo Scientifico PNI)*
Liceo Scientifico Statale “Leonardo Da Vinci” (Treviso), 100/100 honors

GRANTS AND SCHOLARSHIPS

- 2008-2010 Università degli Studi di Padova: graduate school grant
- 6.2008-1.2006 U.S. Particle Accelerator School: scholarships to support the attendance of three courses
- 2002-2007 Scuola Normale Superiore (Pisa): borsa classe di Scienze M.F.N.
- 2001,2002 Fondazione “T. Tessari” (Treviso): high school grant awarded for two years

THEMATIC SCHOOLS

- 4.2011 4th National School (INFN Legnaro): Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics
- 6.2009 MEAD Education S.A. (EPFL): Low-voltage, low-power analog IC design
- 4.2009 3rd National School (INFN Legnaro): Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics
- 6.2008 U.S. Particle Accelerator School (University of Maryland): Medical Applications of Particle Accelerators [Outstanding] Radiation Detection and Imaging for Medicine and Homeland Security [Outstanding-]
- 1.2006 U.S. Particle Accelerator School (Arizona State University at Phoenix): Fundamentals of Accelerator Physics and Technology with Simulations and Measurement Lab [A+]
- 2002 Liceo Scientifico Statale “Leonardo Da Vinci” (Treviso): Two-dimensional technical drawing with Autocad

SUMMARY OF RESEARCH EXPERIENCE AND APPOINTMENTS

- 6.2017-present *Fixed-term Staff Researcher (art. 24/3/a, L. 240, Dec. 31, 2010)*
 Università degli Studi di Padova, Dipartimento di Fisica e Astronomia
 “G. Galilei”
- ERC-granted iPACT project: Geant4 simulation studies of a scintillation calorimeter for a proton Computed Tomography scanner, characterization of constructive elements with proton beam data and bench measurements, development of readout and data processing
 - CMS Experiment, HL-LHC: L1 muon trigger primitives generator with Hough Transform-based algorithms and Majority-based Mean-Timer crossing time identification implemented on FPGA
 - CMS Experiment, HL-LHC: 40 MHz data scouting
- 11.2015-5.2017 *Senior Post-Doctoral Researcher (art. 22, L. 240, Dec. 31, 2010)*
 Università degli Studi di Padova, Dipartimento di Fisica e Astronomia
 “G. Galilei”
- CMS Experiment, HL-LHC: L1 muon trigger crossing time identification with a Majority-based Mean-Timer algorithm implemented on FPGA
 - CMS Experiment, HL-LHC: L1 muon trigger primitives generator with Hough Transform-based algorithms implemented on FPGA
 - Novel implementation of Hough Transform-based pattern recognition, patent number IT102016000018895, co-inventor with P. Zotto and F. Montecassiano
 - CMS Experiment, LHC Run 2: trigger development for the 2017 studies of the B0s → $\mu\mu$ rare decay
 - ERC-granted iPACT project: Geant4 simulation studies of a scintillation calorimeter for a proton Computed Tomography scanner and characterization of constructive elements with proton beam
- 11.2013-10.2015 *Senior Post-Doctoral Researcher (art. 22, L. 240, Dec. 31, 2010)*
 Università degli Studi di Padova, Dipartimento di Fisica e Astronomia
 “G. Galilei”
- CMS Experiment, LHC Run 1 (8 TeV): search for the SM Higgs boson decay to μ pairs
 - CMS Experiment, HL-LHC: muon-seeded L1 track trigger
 - CMS Experiment, HL-LHC: L1 muon trigger primitives generator with Hough Transform-based algorithms implemented on FPGA
 - CMS Experiment, HL-LHC: L1 track trigger software development, validation and maintenance
 - Geant4 simulations of a proton Computed Tomography scanner for medical imaging
- 3.2013-10.2013 *Post-Doctoral Research Grantee*
 Fondazione “Ing. Aldo Gini” with additional financial support by CERN
- CMS Experiment, Tracker Project: service activities, measurement of Pixel Support Tube with reconstructed vertices of nuclear interaction
 - CMS Experiment, HL-LHC: L1 track trigger simulation studies and tool development
- 3.2011-2.2013 *Junior Post-Doctoral Researcher (art. 51/6, L. 449, Dec. 27, 1997)*
 Università degli Studi di Padova, Dipartimento di Fisica “G. Galilei”
- CERN associate member of the personnel, according to the joint CERN-INFN program, from February 2012 to January 2013, for the study of CP violation

- effects in B^0 mixing with the CMS Experiment
- CMS Experiment, LHC Run 1 (7 TeV): $b\bar{b}$ correlated production cross section, $b\bar{b}$ time-integrated mixing probability, mixing-induced lepton asymmetry
- CMS Experiment, HL-LHC: L1 track trigger simulation studies and tool development

1.2008-3.2011

Graduate Student

Università degli Studi di Padova, Dipartimento di Fisica “G. Galilei”

- CMS Experiment, HL-LHC: L1 track trigger simulation studies and tool development
- Characterization of Monolithic Active Pixel Sensors in SOI technology, and TCAD device simulations of the backgating effect
- Geant4 simulations of neutron sources for radiation hardness studies with atmospheric neutron spectrum

11.2004-10.2007

Undergraduate Student

Università di Pisa, Dipartimento di Fisica “E. Fermi”

- CDF Experiment, Tevatron Run 2: methods for the measurement of the top quark mass
- CDF Experiment, Tevatron Run 2: search for the associated production of WZ bosons in the lepton+two b-jets final state

PATENTS

31.20.2019

IT102016000018895: “Method and device for the real-time pattern recognition”, by Pierluigi Zotto, Nicola Pozzobon and Fabio Montecassiano (priority 24.2.2016)

RESPONSIBILITIES - iIMPACT PROJECT

4.2017-present

Simulation studies and data analysis: coordinator of the simulation studies and modeling of the iIMPACT project scanner, of the development of a functional simulation suite of the final iIMPACT scanner, of the development of tools for prompt analysis of proton beam data

6.2017-present

Calorimeter development: calorimeter design and readout architecture optimization

RESPONSIBILITIES - CMS EXPERIMENT

5.2017-12.2017

Drift Tubes Detector Performance Group: responsible of the emulator of the L1 DT trigger

5.2016-12.2017

Muon Upgrade Coordination Office and Phase 2 L1 Trigger Upgrade Group: contact person for the drafting of “The Phase-2 Upgrade of the CMS Muon Detectors Technical Design Report” [CERN-LHCC-2017-012, CMS-TDR-17-003]

5.2011-6.2015

Tracker Detector Performance Group: responsible of the track trigger simulation software development, validation, maintenance, and integration in the CMS SW framework

SUPERVISED STUDENTS - UNIVERSITÀ DEGLI STUDI DI PADOVA

5.2019-present

Sofia Sartori: partial supervision during her *laurea* in Physics: studies of the sources of fluctuations in the signal yield with plastic scintillators for the calorimeter of the ERC-granted iIMPACT project proton Computed Tomography

scanner

- 10.2018-present Filippo Baruffaldi: partial supervision during his Ph.D. in Physics within the iMPACT project: development of a full-scale calorimeter for the ERC-granted iMPACT project proton Computed Tomography scanner
- 11.2017-4.2018 Chiara Bonini: partial supervision during her *laurea* in Physics: “Development of an achromatic calorimeter for medical protons”, characterization with proton beam of a scintillation calorimeter for the ERC-granted iMPACT project proton Computed Tomography scanner
- 4.2017-12.2017 Filippo Baruffaldi: co-advisor for his *laurea magistrale* in Physics: “Studies for a proton tomography scanner”, simulation studies and characterization with proton beam of a scintillation calorimeter for the ERC-granted iMPACT project proton Computed Tomography scanner
- summer 2013 Claudio Ledovich: partial supervision during his *laurea magistrale* in Physics: study of the systematic uncertainty on the time-integrated probability of B mesons due to the discrepancies between muon jets kinematics and their parent B hadron flight direction
- summer 2011 Alberto Zucchetta: partial supervision during his *laurea magistrale* in Physics: determination of the heavy flavour content of hadron jets with muons in pp collisions with the CMS Experiment

NATIONAL ACADEMIC QUALIFICATION (ABILITAZIONE SCIENTIFICA NAZIONALE) AND OTHER QUALIFICATIONS

- 5.12.2017-5.12.2023 Associate professor (*funzioni di professore universitario di Seconda Fascia*): experimental HEP (*settore concorsuale 02/A1 Fisica Sperimentale delle Interazioni Fondamentali*)
- 12.2016 Qualified as 3rd level INFN staff researcher (*Idoneità per il profilo professionale di Ricercatore di III livello INFN*): INFN call 18221 (2016), 3rd level INFN staff researcher in experimental HEP, particle accelerators and technology development for various applications (*bando INFN 18221 (2016), Ricercatore di III livello con contratto di lavoro a tempo indeterminato, per attività di ricerca nel campo della fisica sperimentale delle interazioni fondamentali, delle tecniche di accelerazione di particelle, dello sviluppo tecnologico di metodologie fisiche utilizzabili in diversi contesti applicativi*)

ACADEMIC BOARDS - UNIVERSITÀ DEGLI STUDI DI PADOVA

- since 1.2018 Ph.D. School in Physics: Member of the College of the Ph.D. School in Physics

FUNDING AND RESEARCH GRANTS

- 2018 MIUR: *FFABR - Fondo per il finanziamento delle attività base di ricerca*, used for the procurement of equipment for the qualification of the iMPACT project calorimeter
- 3.2013-8.2013 Fondazione “Ing. Aldo Gini”: six-months postdoctoral research grant, based at CERN, for the development of the silicon tracker of the CMS Experiment in view of the HL- LHC upgrade program
- 2.2012-1.2013 CERN: associate member of the personnel, joint CERN-INFN program, one-year term subsistence funding for the study of CP violation effects in B0 mixing with

the CMS Experiment

OTHER RESEARCH-RELATED EXPERIENCE

10.2014-3.2015 SISSA Medialab: external contractor as LATEX typesetter for the final typographic setup of scientific articles published on the *JCAP*, *JHEP* and *JINST* journals

RESEARCH EXPERIENCE IN DETAIL

CDF EXPERIMENT

I joined the CDF Collaboration as an undergraduate student at Università di Pisa in late 2004. I completed both my *laurea* and *laurea specialistica* theses supervised by Giorgio Bellettini and, respectively, Guram Chlachidze (JINR) and Gueorgui V. Velev (Fermilab).

TOP QUARK PHYSICS

11.2004-7.2005 *Techniques for the measurement of the top quark mass*
The measurement of the top quark mass with the template method at the Tevatron suffered from poor jet energy reconstruction. One possible improvement is to enhance hadron jet selection, requiring that the number and energy of jets is stable against the jet size parameter.

- I compared the top quark mass reconstruction in lepton-plus-jets simulated signal samples before and after applying a topological event cleaning, where leading jets are correctly reconstructed using two different cone sizes.
- The study is documented in note CDF 7869 (2005), and in FERMILAB-BACHELORS-2005-03.

VECTOR BOSON PHYSICS

12.2006-10.2007 *Search for the WZ associated production*
The associated production of W and Z bosons at the Tevatron is a fundamental background for the low-mass SM Higgs boson search. This was the first attempt at measuring the WZ associated production in 1.38 fb^{-1} of Tevatron Run 2 data with a single lepton, missing E_T and jets with secondary vertex b-tags.

- I ported to a new context the sound technique used at CDF to measure the $t\bar{t}$ production cross section in the lepton plus jet final state. I improved the signal fraction with secondary vertex tagging of b-flavored jets.
- I developed a dedicated set of jet energy corrections for a better reconstruction of the Z mass with b-flavored jets, under the supervision of dr. G. Latino (INFN Pisa). I showed that the typical assignment of the two leading jets of the event to reconstruct the Z candidate could not be the correct choice. This problem was later addressed by the CDF Pisa group in *Nucl. Instrum. Meth. A* **738** (2014) 154-166 [doi:10.1016/j.nima.2013.12.003].
- I extracted the signal fraction with a maximum likelihood technique, but the large uncertainty in renormalization factors from data to MC simulations allowed only to put an upper limit well consistent with SM expectations.
- The study is documented in notes CDF 9005, 9006, and 9007 (2007), and in FERMILAB-MASTERS-2007-01.

MAPS IN SOI TECHNOLOGY

I attended the Ph.D. School in Physics at Università degli Studi di Padova. I joined the silicon detector laboratory led by Dario Bisello to enhance my experience in experimental Physics and instrumentation development. The following activities characterized the first half of my Ph.D. program.

4.2008-12.2010

Characterization of MAPS detectors and simulation studies of backgating effect in SOI pixel detectors

Monolithic arrays of pixel sensors (MAPS) started to be considered as viable options for novel detectors to be used at future HEP experiments in the late 2000's. One such promising technology was the Silicon-On-Insulator (SOI), integrating a high-resistivity sensitive volume and a read-out on low-resistivity substrate into a single device, without needing any additional interconnection. Such a technology can reduce the material budget of a tracking apparatus if compared to previous technologies, i.e. bump-bonded hybrid pixels. One of the main radiation-induced degrading effects on SOI devices is the so-called back-gating: charge deposition on buried oxide surfaces changes the substrate potential, thus gating the transistors in the upper volume with smaller voltages than the design ones. This project was part of the SOIPIX consortium program with LBNL and KEK.

- I participated to the ongoing characterization campaign of MAPS prototypes developed by Padova and Berkeley with lasers and radioactive calibration sources.
- I contributed to the development of a GUI for a custom DAQ system for the read-out of the different prototype detectors developed by the collaboration.
- I conducted a wide campaign of simulation studies with Sentaurus TCAD of backgating effect in SOI pixel detectors, in order to understand measured I - V curves and to determine design parameters, such as dopings and guard rings, for future submissions. I was trained in Berkeley by Devis Contarato (LBNL) in the group led by Marco Battaglia (UCB-UCSB) as a guest of the strategic LDRD (Laboratory Directed Research and Development) project LB08028.
- I participated to the evaluation of LRDR-SOI-1 prototype and to the definition of design features of the LRDR-SOI-2 prototype. I also participated to the test beam evaluation of the LRDR-SOI-mager-2 prototype with pion beam at the CERN SPS and showed, from cluster size and multiplicity, that an on-line selection of high pT tracks in future collider experiments cannot be based on cluster width only.
- The results of this work were included in my Ph.D. thesis CERN-THESIS-2011-029, in *IEEE Trans. Nucl. Sci.* **57** (2010) 2135 [doi:10.1109/TNS.2009.2038378], and in *Nucl. Instrum. Meth. A* **650** (2011) 184-188 [doi:10.1016/j.nima.2010.11.185].

SPES FACILITY AT INFN LEGNARO NATIONAL LABORATORIES

As a side project during my Ph.D. program, I contributed to the proposal for a proton- induced neutron source for radiation hardness studies to be installed at the SPES (Selective Production of Exotic Species) facility at INFN Legnaro National Laboratories.

summer 2009

Geant4 simulations of a proton-induced neutron source

The core of the SPES facility at INFN Legnaro laboratories is a 70 MeV proton cyclotron. These protons can be used to produce neutrons with inelastic collisions on a target. The spectrum of outgoing neutrons can be tuned

according to different needs changing the features of the target.

- I developed a Geant4-based simulation software together with Jeffery Wyss (Cassino) to evaluate the impact of target and experimental room shape and materials, in order to reproduce the high-atmosphere neutron spectrum.
- The results were used to promote the realization of a neutron source for radiation hardness studies at the SPES facility during the discussion seminar “Neutron Sources and their INFN applications”, November 2009, INFN Legnaro in the contribution presented by Jeffery Wyss “Neutroni negli studi di radiation hardness” [www.lnl.infn.it/%7Elndir/Seminario%20sorgenti/].
- The project then evolved in the NEUTARGS experiment.

CDF EXPERIMENT

I joined the CMS Collaboration in 2008 during my Ph.D. program at Università degli Studi di Padova. I was encouraged to complete it with a thesis on the recently proposed Level 1 Tracking Trigger because of my peculiar background made of both fundamental physics data analysis and instrumentation development, focusing on the impact of the design on the expected physics performance. After the discovery of the SM Higgs boson without other evidence of new Physics, I chose to focus on the High Luminosity-LHC upgrades of the CMS Experiment, in view of the discovery potential of an experimental apparatus featuring higher efficiency, larger acceptance, and designed to collect extremely large statistics of proton-proton collision data.

UPGRADE OF THE SILICON TRACKER FOR THE HL-LHC

I dedicated the second part of my Ph.D. program working on several topics related to the upgrade of the silicon tracker for the HL-LHC, increasing my commitment during my post-doctoral years. The following activities were part of the mission of the CMS Track Trigger Task Force, Tracker Upgrade Simulation Working Group, and Track Trigger Integration Working Group.

9.2009-10.2015

Track trigger simulation studies

The High Luminosity upgrade of the LHC will extend the physics reach of the experiments, providing a collision rate which cannot be sustained by the original design of muon and calorimeter L1 triggers, unless thresholds are increased up to losing the sensitivity to the EW scale. The necessary resolution can be provided by a novel silicon tracker specifically designed for track finding at L1 trigger. Such a tracker is made of modules providing primitives built from pattern hit correlation in closely spaced $O(1)$ mm parallel sensors, corresponding to a discrimination power on tracks with $pT > 2$ GeV/c that filters out more than 90% of data from minimum-bias events. These track stubs are the input to the L1 track finding.

- I evaluated the impact of different options for local cluster and stub finding in the front-end on the trigger multiplicity and fake rate with Marcello Mannelli (CERN) during my Ph.D. program.
- I wrote the very first simulation of L1 track finding, based on the extrapolation of tracklet seeds, i.e. stub pairs, showing its benefits in a combined track-calorimeter trigger.
- The results of this work were included in my Ph.D. thesis CERN-THESIS-2011-029, in note CMS DN-2012/003, and in a poster presented to the 105th LHCC student session.
- My commitment with track trigger continued as a service task until late 2015, according to the following topic list. I became the responsible of the maintenance, documentation and update of the track trigger simulation

software in CMS SW since summer 2011 until the publication of the “Technical Proposal for the Phase-II Upgrade of the CMS Detector” [CERN LHCC-2015-010] [cds.cern.ch/record/2020886].

- **software integration** I improved and substantially renewed the existing simulation tools to be fully integrated in the CMS SW framework, allowing for their use in standardized and centrally-manged production of simulated events for general use by CMS with Emmanuele Salvati (Cornell), coordinated by Gaelle Boudoul (Lyon) and David Lange (Livermore).
- **geometry** I developed the necessary software for supporting tracker endcap trigger modules by CMS SW, based on the geometry description in xml format. I validated several layouts produced with the tkLayout tool, with Stefano Mersi and Giovanni Bianchi (CERN). I improved tkLayout tool to automatize the production of the geometry files given the layout features. I developed a new numbering scheme for the identification of tracker elements to cope with requirements of both track trigger and offline reconstruction.
- **clusters and stubs** I simulated new algorithms for cluster and stub finding guided by the design of the front-end, including several cycles of cross-validation and consistency check of expected performance and features with front-end and back-end developers, with Sebastien Viret (Lyon), coordinated by Duccio Abbaneo (CERN).
- **L1 track finding** I further developed my prototype L1 track finding for full integration in the CMS SW framework for use in standardized and centrally-manged production of simulated events.
- **data formats and MC truth** I defined the data formats for track trigger simulations, representing a minimal and complete description set. I developed a dedicated MC-truth association tool marking a major step in the evaluation of track trigger performance. The goodness of this tool was evaluated with Gaelle Boudoul, Sebastien Viret (Lyon) and Andrea Venturi (INFN Pisa).
- **validation** I developed validation tools for the geometry and the track trigger objects (clusters, stubs and tracks), testing all the libraries and data formats used in the simulation. These were later used to develop dedicated Data Quality Monitoring tools.
- **support** I provided the necessary support to starting activities, in particular to a development of CMS Fast Simulation for the HL-LHC and to the development of a PCA fitter for AM-based track trigger.
- Results of my validation campaign have been included in the Tracker chapter of the “Technical Proposal for the Phase-II Upgrade of the CMS Detector” [CERN LHCC-2015-010] [cds.cern.ch/record/2020886] and became common material for the CMS Collaboration.

12.2009-10.2013

Combined calorimeter and tracker τ trigger

Confirmation of calorimeter τ -candidates with L1 tracks is crucial to improve the purity of hadronically-decaying τ samples at the HL-LHC, also providing a lower trigger rate.

- I used my first prototype algorithm for L1 track finding to confirm L1 calorimeter τ -like clusters and improve the definition of candidate τ leptons at L1. I showed that a major improvement in terms of efficiency, purity and trigger rates comes from isolation criteria based on vertex association.
- The results of this work were included in my Ph.D. thesis CERN-THESIS-2011-029, in note CMS DN-2012/003, and in a poster presented to the 105th LHCC student session.
- I maintained the software updating the results, within the working group coordinated by Anders Ryd (Cornell) and Emmanuel Perez (CERN) until I later moved to muon track trigger studies.
- The study has been resumed later by Alexandros Attikis (Cyprus) and

Anders Ryd (Cornell) and continued until the publication of the “Technical Proposal for the Phase-II Upgrade of the CMS Detector” [CERN LHCC-2015-010] [cds.cern.ch/record/2020886].

10.2013-10.2015

DT-seeded muon track trigger

Improving the resolution of standalone muon triggers at the HL-LHC is crucial for maintaining the sensitivity to the EW scale. A back-extrapolation of DT trigger primitives is proposed to link L1 tracks to muon candidates. Such algorithm features sharp thresholds and less contamination from lower momentum muons, and an expected rate reduction factor 5-10 at typical thresholds with respect to an upgrade-less scenario.

- I joined in 2014 Pierluigi Zotto, Sara Vanini (Padova) and Ignazio Lazzizzera (Trento), who began these studies back in 2010. I improved and significantly updated the existing tools, profiting from my long experience in track trigger simulations. I integrated this software in the CMS SW framework for its use in standardized and centrally-managed production of simulated events.
- I improved the back-extrapolation of the DT seed and the resulting efficiency in matching with L1 tracks.
- I validated this study and brought it to final approval by the CMS collaboration [CMS DP-2015/008] [cds.cern.ch/record/2017712] within the working group coordinated by Anders Ryd (Cornell) and Emmanuel Perez (CERN).
- This study has also been included in the Trigger chapter of the “Technical Proposal for the Phase-II Upgrade of the CMS Detector” [CERN LHCC-2015-010] [cds.cern.ch/record/2020886] and presented by myself to the 13th Pisa Meeting on Advanced Detectors on behalf of the CMS Collaboration.
- Both this study and the updated τ calo-track trigger study have been documented in detail in note CMS DN-2014/002.

I presented updates on track trigger development and expected performance of CMS at the HL-LHC on behalf of the CMS Collaboration to five international conferences: 13th ICATPP [CMS CR-2011/281], 13th VCI 2013 [CMS CR-2013/054], 14th ICATPP [CMS CR-2013/332], TWEPP2014 [CMS CR-2014/248], and EPS-HEP 2016 [CMS CR-2015/164].

FLAVOUR PHYSICS

I started working on flavour physics measurements in 2011 with Franco Simonetto and Martino Margoni (Padova), after I completed my Ph.D. program. The group already started in 2010 a campaign of studies with the ultimate goal of measuring the CP violation in the b-quark sector with the CMS Experiment.

3.2011-6.2012

Measurement of correlated BB^ production cross section*

The measurement of the $pp \rightarrow bb^*X$ production cross section in final states with at least two muons, searching for anomalies, is the first step towards the measurement of CP violation in the b-quark sector.

- I estimated the systematic uncertainties due to the resolution in impact parameter, to the modeling of templates distributions used for the determination of the bb^* fraction, and to the binning of the histograms used to create the impact parameter distributions, with Martino Margoni, Gabriele Simi (Padova), Fotios Ptochos, Mario Galanti (Cyprus) and Luca Perrozzi (Padova-CERN).
- This measurement was documented in note CMS AN-2011/059 and

1.2012-7.2013

Study of the time-integrated mixing probability of neutral B mesons

The measurement of the time-integrated mixing probability $\bar{x}$ is also preliminary to the measurement of CP violation in the b-quark sector. The measurement relies on the determination of the BB fraction, as for the measurement of the $pp \rightarrow b\bar{b}X \rightarrow \mu\mu X$ production cross section, whilst the discrimination variable in this case is the relative transverse momentum of the muon inside a jet, p_T^{rel} , allowing for a better discrimination of sequential $b \rightarrow c \rightarrow \mu$ decays.

- I developed a data-driven method to extract p_T^{rel} template of the light-flavored meson T background, with Mario Galanti (Cyprus-Padova), Jacopo Pazzini (Padova) and Luca Perrozzi (CERN).
- The study is documented in note CMS AN-2012/147. The outsourcing of a public result has been suspended because of critical aspects of the signal simulation and the contextual change of priorities of the CMS BPH group, focussing on the rare decays of B mesons to muon pairs.

1.2012-7.2013

Study of the CP-violation induced dilepton asymmetry

The mixing-induced dilepton asymmetry is defined as $A_{\text{ll}} = (N_{\text{BB}} - N_{\text{B}\bar{\text{B}}}) / (N_{\text{BB}} + N_{\text{B}\bar{\text{B}}}) = (N_{++} - N_{--}) / (N_{++} + N_{--}) \approx 2(1-q/p)$, where p and q are the linear superposition coefficients of the B^0 and B^{0*} wavefunctions. Any discrepancy from $A_{\text{ll}} = 0$ would be an indication of CP violation.

- I developed and monitored, with Mario Galanti (Padova), a dedicated trigger to collect same-sign dimuon events which has been integrated in the 8 TeV collisions CMS trigger menu for 2012. The trigger was designed to achieve a high purity of the sample, as the statistical precision needed to compare the result with theoretical predictions is of the order of 0.1%.
- I adapted the analysis framework to make a combined use of the impact parameter and p_T^{rel} to achieve maximal discrimination power to estimate the BB^* fraction, with Mario T Galanti and Jacopo Pazzini (Padova).
- Some of the analysis tools I contributed to develop for the study of BB^* mixing and CPV induced dilepton asymmetry were later used for the evaluation of muon misidentification rates in the search for the rare decay $B_0 \rightarrow \mu\mu$ described in *Phys. Rev. Lett.* **111** (2013) 101804 [doi:10.1103/PhysRevLett.111.101804].

1.2017-6.2017

Trigger development for the study of the $B_0 \rightarrow \mu\mu$ rare decay

Rare B decays provide for many topics in testing the SM and searching for new physics. In particular, the $B_0 \rightarrow \mu\mu$ and $B_0 \rightarrow \mu\mu$ decays are effective FCNC, forbidden at tree-level and proceeding through Z-penguin and box diagrams, furthermore helicity suppressed. The $B_0 \rightarrow \mu\mu$ rare decay was observed by both CMS and LHCb in 2013, and a detailed assessment of its properties, together with the observation of the $B_0 \rightarrow \mu\mu$ decay, represents the following step in the study of this particular process.

- I evaluated the proposed High-Level Trigger path for the collection of signal and normalization samples with low p_T dimuon events, in particular I estimated the expected rates with the operation conditions during 2017 and I participated to the monitoring of the trigger during the year, together with Roberto Rossin and Alessio Boletti (Padova).

I presented updates on flavour physics measurements on behalf of the CMS, Atlas, Alice and LHCb Collaborations at three international conferences: CRIMEA 2011 [CMS CR-2011/282], XI HQL 2012 [CMS CR-2012/160], and XXVII

VECTOR BOSON PHYSICS

When I started my first post-doctoral assignment, the CMS Padova group was studying the possibility to measure the SM Z production in $b\bar{b}$ final states with soft leptons at LHC, under the coordination of Tommaso Dorigo.

summer 2011

Measurement of the heavy flavor content of muon jets

The measurement of $Z \rightarrow b\bar{b}$ decays in inclusive low- p_T muon data is a challenge that can prove that small dijet resonances can be extracted from large QCD background. Also, it can help to verify several assumptions on MC modeling, JES, jet energy resolution, b-tagging efficiency, as well as to set up strategies to model the background mass shape.

- I contributed to the validation of the heavy flavor content estimate with an unbinned likelihood fit on muon impact parameter d and relative momentum to the jet p_T^{rel} in inclusive muon jet samples and in enhanced samples with b-tagged jets, with Alberto Zucchetta (Padova) as part of his *laurea magistrale* thesis work.
- I validated the event selection criteria, in a comparison with $Z \rightarrow \mu^+\mu^-$ decays.
- I evaluated the systematic uncertainties on the b-fraction estimate associated to the data/MC scale factor.
- This work has been documented in note CMS AN-2011/483, and became the basis of a tool used in a later search for a MSSM Higgs boson production in association with b quarks, published in CMS-PAS-HIG-12-027 (2012) and *Phys. Lett. B* **722** (2013) 207 [doi:10.1016/j.physletb.2013.04.017].

UPGRADE OF THE PIXEL DETECTOR

I was awarded a research grant by Fondazione ‘‘Ing. Aldo Gini’’ in 2013 to spend six months at CERN on the CMS tracker upgrades. My financial support at CERN was completed by the CMS Tracker Project and extended to eight months. Besides track trigger activities, I was involved in the technical task of measuring the position of the mechanical structure supporting the CMS pixel detector, in view of its replacement during the Phase 1 upgrades.

3.2013-7.2013

Measurement of passive materials in tracker volume

The upgrade of the CMS pixel detector requires the design of a dedicated mechanical support which must fit within the existing Pixel Support Tube. The accuracy of this design is crucial as the expected clearance with the upgraded pixel detector is few millimeters. The support mechanics must then compensate any asymmetries due to misalignment or misplacement of the structures which are not being replaced.

- I measured the position of the Pixel Support Tube using reconstructed vertices of nuclear interactions in the material, measuring its displacement and the two different diameters of its elliptical section, under the coordination of Nicola Bacchetta (INFN Padova), Gino Bolla (Purdue) and Giacomo Sguazzoni (INFN Firenze).
- This work has been documented in note CMS AN-2016/308, and published in *JINST* **13** (2018) P10034 [doi:10.1088/1748-0221/13/10/P10034].

HIGGS BOSON PHYSICS

I started in late 2013 my second post-doctoral assignment in Padova. One of the planned research topics was the search for SM Higgs decaying to muon pairs.

7.2014-10.2014

Search for the SM Higgs boson decay to two muons

In summer 2014 the CMS Collaboration published the results for an inclusive search of the SM Higgs boson decaying to a muon pair. Final states with muons and jets are categorized in order to enhance sensitivity for the $gg \rightarrow H$ and VBF production modes. Associated production such as ZH was not taken into account yet, because of its smaller cross section, and it is expected to give little contribution to this search.

- I conducted a preliminary study together with Alberto Zucchetta and Martino Dall'Osso (Padova), focusing on the determination of the expected signal yield in data collected at 8 TeV in 2012, seeking for the associated production of a SM Higgs boson with a Z boson, in the exclusive $bb\bar{\mu}\mu$ -final state with the Z boson decaying in two b-jets. This work is based on the search for new physics in the $A \rightarrow Zh \rightarrow l\bar{l}bb$ channel published in *Phys. Lett. B* **748** (2015) 221-243 [doi:10.1016/j.physletb.2015.07.010].
- Given the extremely low expectations on signal yield, the measurement was dropped.
- This study has been documented in note CMS AN-2014/238.
- I was appointed to be an instructor at the CMS Upgrade School in DESY, November 2014. I prepared and directed the long-exercise session on optimizing a detector design for high- p_T muons, using $H \rightarrow \mu\mu$ as a test case.

UPGRADE OF THE DT TRIGGER

During my second postdoctoral assignment I started studying the problem of muon trigger at the HL-LHC, as the CMS Padova unit chose to concentrate the resources of the group on this upgrade effort. In fact, the CMS Drift Tube system was designed and built with the fundamental contribution of the CMS Padova unit, which still keeps the expertise for its optimal exploitation at the HL-LHC. I personally proposed a new approach to local muon trigger in the CMS barrel region, which became the main subject of my third postdoctoral assignment, with Pierluigi Zotto and Fabio Montecassiano (Padova). I am currently leading the performance studies and the architecture design in close contact with the INFN Padova engineers, requiring my constant presence in Padova.

11.2014-present

Local DT trigger with Hough Transform on FPGA

The synchronous approach originally designed for the generation of local triggers in the DT chambers of the CMS Experiment at the LHC cannot be ported to the HL-LHC scenario, as raw data will be driven off-detector with a time-stamped asynchronous feed. The implementation of Hough Transform in FPGA can meet all the requirements for a local DT trigger at the HL-LHC, including reliable long-time operation at $O(10)$ MHz input rate, with few μ s latency, and robustness against spurious hits, left-right ambiguities of the DT cell readout, and off-time hits due to the long integration time of the DT.

- I personally proposed a Hough Transform-based local DT trigger upgrade implemented in FPGA for the HL-LHC.
- I developed a generalization of the algorithm based on clever partitioning of the input dataset and a compact implementation of Hough Transform featuring parameter reduction. Such general algorithm is taught in patent number IT102016000018895 "Method and device for the real-time pattern

recognition”, by Pierluigi Zotto, Nicola Pozzobon and Fabio Montecassiano, with priority dating back to February 24, 2016.

- I proposed the design of a static implementation of a majority-based mean-timer technique for the direct identification of muon crossing time in the local DT Trigger.
- I wrote a flexible C++ simulation software to evaluate the required resources of the FPGA device. The software is fully compatible with the CMS framework for evaluation against full Geant4 simulation of CMS DT chambers and real data.
- I also developed a C simulation with fully-integer representation of the algorithm, to guide a Vivado High Level Synthesis into RTL, together with Fabio Montecassiano (INFN Padova).
- Both have been merged into a single simulation tool with arbitrarily trimmed precision in the representation of measured quantities and internal variables, which has been used for a major optimization towards a deployable firmware implementation.
- I was appointed contact person between the Muon Upgrade Coordination Office and the Phase 2 L1 Upgrade Group in May 2016, and responsible of the L1 emulator within the Drift Tubes Detector Performance Group in May 2017.
- I developed a streamed version of the algorithm reproducing a realistic operation mode of the trigger, together with a FIFO and buffer model for data collection from the DT chambers.
- The fundamental block of the algorithm, the bunch crossing identification, was successfully run on two different Xilinx UltraScale FPGA boards, of both Virtex and Kintex families, with a per-channel resource use comparable to the legacy BTI processor, and a controlled latency shorter than 0.5 μ s.
- I integrated the emulation of the algorithm in the CMS framework for the performance studies needed to draft the Technical Design Report of the Level 1 Trigger Upgrade expected in late 2019/early 2020. I personally defined the precision scale of the data formats of the DT Trigger Primitives.
- I am progressing in the optimisation of the algorithm after its evaluation with proton-proton dimuon collision data at the Z peak, while participating to its integration on a full DAQ chain of a reduced scale DT chamber.
- The first feasibility study has been published in *Nucl. Instrum. Meth. A* **834** (2016) 81-97 [doi:10.1016/j.nima.2016.07.020].
- Further progress of this activity was presented to the CTD2016 workshop at HEPHY (invited talk) and to IEEE-RT2016, as well as published in *EPJ Web of Conferences* **127** (2016) 00012 [doi:10.1051/epjconf/201612700012] and *IEEE Trans. Nucl. Sci* **64** (2017) 1474-1479 [doi:10.1109/TNS.2017.2691358].
- This project has been included in the Muon trigger chapter of the “The Phase-2 Upgrade of the CMS Muon Detectors Technical Design Report” [CERN LHCC-2017-012] [cds.cern.ch/record/2283189].

PROTON COMPUTED TOMOGRAPHY

Padova hosts the iMPACT *innovative Medical Proton Achromatic Calorimeter and Tracker* project, funded by the European Research Council under the European Union’s Horizon 2020 research and innovation programme, with the goal of building a novel proton Computed Tomography scanner for protons of medical energies in the range between 200 and 300 MeV. Such device will be an advanced proton tracking system that provides accurate information to create a map of the tissue density of human organs. This information, crucial for an accurate aiming of proton-therapy beam depth, is currently provided by

X-rays CT scans, with an accuracy lower than could be achieved by using protons. One of its core elements is a high-granularity scintillator-based range calorimeter, designed to measure the proton residual energy after it travels the patient's body. I contributed to this effort with the expertise I gained in simulations and trigger over the years, and I officially joined the project in 2017, as a fixed-term staff researcher in Padova ("ricercatore a tempo determinato di tipo A").

winter 2014

Geant4 simulations for pCT R&D

The reconstruction of the proton kinematics before and after traveling a body to be probed requires high efficiency and resolution. The density of tissues can be inferred only with an accurate measurement of the energy lost by the proton inside the patient.

- I wrote Geant4 simulations for dimensioning an integrated tracker-calorimeter pCT device which have been used in the drafting of the iMPACT proposal submitted to the ERC Consolidator Grant 2014 call (P.I. Piero Giubilato).

4.2017-present

Development of a scintillation calorimeter for pCT

The iMPACT project design features a scintillator-based hybrid energy-range calorimeter to measure the residual proton energy after scattering. Silicon Photo-Multipliers are employed to convert the light primary signal into an electric signal. The proton path length inside the calorimeter and the position of its peak energy loss are measured thanks to a fine segmentation of the calorimeter volume. The maximal resolution that can be obtained has particular importance in designing the calorimeter and its read-out. In order to design and build an effective calorimeter, a characterisation and prototyping campaign has started in spring 2017.

- I participated to studies with proton beam data in order to evaluate the response of plastic scintillator to single particle in different energy ranges and characterise the chosen material, with P. Giubilato, S. Mattiazzi, D. Pantano and F. Baruffaldi (Padova).
- I participated to the development of a dedicated simulation of the calorimeter parts in the Geant4-based GATE framework with F. Baruffaldi (Padova), with both the goals of tuning the parameters describing the plastic scintillator response and disentangling the single-photon response of the scintillator and the readout signal shaping.
- I focused on the need of reducing the data volume, showing how a readout based on three non-equally spaced thresholds allows to retain enough information for the measurement of the proton range inside the calorimeter, with proton beam data collected with a sub-modular prototype.
- I am currently participating to the forthcoming campaign of tests with proton beam on a larger scale prototype, featuring also part of the tracking detector, built with a dedicated assembly of ALPIDE sensors from the ALICE experiment, focusing on the design of the experimental setup and on the procurement of additional instrumentation from vendors.
- I am participating to the design of a full-scale prototype of the calorimeter, after improvements of the readout electronics, and I am coordinating its description within a Geant4 simulation oriented to the preliminary evaluation of its performance and to the optimisation of the data compression scheme. I presented updates on the iMPACT project activities to the 14th Pisa Meeting on Advanced Detectors. These activities, as well as earlier developments of pCT-oriented proton tracking detectors, are documented in *Radiat. Prot. Dosimetry* **166** (2015) 388-392 [doi:10.1093/rpd/ncv197], *JINST* **10** (2015) C05004 [doi:10.1088/1748-0221/10/05/C05004], *IEEE NSS/MIC* (2016) [doi:10.1109/NSSMIC.2015.7581240], *Nucl. Instr. Meth. A* **845** (2016) 664-

667 [doi:10.1016/j.nima.2016.04.105], *IEEE Trans. Rad. Plasma Med. Sci.* **2** (2018) 345-352 [doi:10.1109/TRPMS.2018.2825499], *Nucl. Instrum. Meth. A* **936** (2019) 1-4 [doi:10.1016/j.nima.2018.10.155].

WORKSHOPS AND CONFERENCES

PERSONAL CONTRIBUTIONS

- | | |
|--------------------|--|
| 9.2019
plenary | TWEPP2019, Santiago de Compostela
FPGA implementation of a histogram-based parent bunch-crossing identification for the Drift Tubes chambers of the CMS experiment
(<i>designated speaker by CMS</i>) |
| 7.2019
plenary | 21st iWoRiD, OAC Kolymbari (Crete)
The CMS Muon System: performance during the LHC Run-2 |
| 5.2018
plenary | 14th Pisa Meeting on Advanced Detectors, INFN Pisa (La Biodola)
Calorimeter prototyping for the iMPACT project pCT scanner, <i>Nucl. Instrum. Meth. A</i> 936 (2019) 1-4 [doi:10.1016/j.nima.2018.10.155] |
| 6.2016
poster | IEEE-NPSS Real Time 2016, Padova
Design of a Compact Hough Transform for a new L1 Trigger Primitives Generator for the upgrade of the CMS Drift Tubes muon detector at the HL-LHC, <i>IEEE Trans. Nucl. Sci.</i> 64 (2017) 1474-1479
[doi:10.1109/TNS.2017.2691358] |
| 2.2016
invited | Connecting The Dots 2016, HEPHY Wien
A proposal for the upgrade of the muon Drift Tubes trigger for the CMS experiment at the HL-LHC, <i>EPJ Web of Conferences</i> 127 (2016) 00012
[doi:10.1051/epjconf/201612700012] |
| 7.2015
poster | EPS-HEP 2015, Universität Wien
Future physics potential of the CMS Phase II detector, PoS(EPS-HEP2015)236 [CMS CR-2015/164] |
| 5.2015
poster | 13th Pisa Meeting on Advanced Detectors, INFN Pisa (La Biodola)
A proposed DT-seeded muon track trigger for the CMS experiment at the HL LHC, <i>Nucl. Instrum. Meth. A</i> 824 (2016) 346-348
[doi:10.1016/j.nima.2015.09.100] [CMS CR-2015/112] |
| 9.2014
poster | TWEPP2014, Aix-en-Provence
Proposed FPGA-based tracking for a Level-1 track trigger at CMS for the HL-LHC [CMS CR-2014/248] |
| 3.2014
plenary | IFD - INFN Workshop on Future Detectors, Università di Trento
L1 Muon Trigger at the HL-LHC: the INFN community view of the Atlas and CMS perspectives, PoS(IFD2014)030 |
| 9.2013
parallel | 14th ICATPP, Centro Studi "A. Volta", Como
Tracking at early trigger level for the CMS upgrade for HL-LHC, World Scientific, Vol. 8 of the Astroparticle, Particle, Space Physics, Radiation Interaction, Detectors and Medical Physics Applications Series
[doi:10.1142/9789814603164_0063] [CMS CR-2013/332] |
| 2.2013
plenary | XXVII Rencontres de Physique de la Vallée d'Aoste, INFN Pisa (La Thuile)
Heavy Flavor production and spectroscopy at CMS, <i>Nuovo Cimento C</i> 36 (2013) 126 [doi:10.1393/ncc/i2014-11625-6] [CMS CR-2013/065] |

2.2013 parallel	13th VCI 2013, TU, Wien Development of a Level 1 Track Trigger for the CMS experiment at the high-luminosity LHC, <i>Nucl. Instrum. Meth. A</i> 732 (2013) 151 [doi:10.1016/j.nima.2013.06.010] [CMS CR-2013/054]
6.2012 parallel	11th HQL 2012, Charles University, Prague Production and Properties of b-Hadrons at the LHC, PoS(HQL 2012)002 [CMS CR-2012/160]
10.2011 parallel	13th ICATPP, Centro Studi “A. Volta”, Como A Level 1 Tracking Trigger for the CMS Experiment, World Scientific, Vol. 7 of the Astroparticle, Particle, Space Physics, Radiation Interaction, Detectors and Medical Physics Applications Series [doi:10.1142/9789814405072_0096] [CMS CR-2011/281]
9.2011 plenary	CRIMEA-2011, New Trends in High Energy Physics, BITP, Kiev (Alushta) Heavy-Flavor Physics with the CMS Experiment [crimea.bitp.kiev.ua/2011/book/] [CMS CR-2011/282]
3.2011 poster	105th LHCC, CERN A Level 1 Tracking Trigger for the CMS Experiment at the LHC Phase 2 Luminosity Upgrade

EVENT ORGANISATION

4.2019	8th Interational Course “Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics”, INFN Legnaro
3.2015	6th National School “Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics”, INFN Legnaro
11.2014	CMS Upgrade School, DESY, Hamburg instructor long-exercise session on high- p_T muons
4.2011	4th National School “Detectors and Electronics for High Energy Physics, Astrophysics, Space Applications and Medical Physics”, INFN Legnaro

TEACHING

2017, 2018 lecturer	Università degli Studi di Padova, DII Elements of Physics (EM and Optics, 6 CFU) for the Chemical and Material Engineering School, 54 hours per year
spring 2017 teaching assistant	Università degli Studi di Padova, DAFNAE General Physics (8 CFU) for the Viticulture and Enology School, 20 hours
spring 2017 lab assistant	Università degli Studi di Padova, DFA “G. Galiei” Introductory Physics Lab for the Physics School, 25 hours
spring 2017 teaching assistant	Università degli Studi di Padova, DAFNAE General Physics (8 CFU) for the Viticulture and Enology School, 20 hours
winter 2016/2017 co-lecturer	Nido integrato “Piccole Impronte” e Scuola dell'infanzia “B.G. di Collalto” “Scientists at the age of 2: science projects in kindergarten”, and “Little scientists: science projects in pre-primary school”, with dr. C. Tosatto, psychologist, total of 14 hours

spring 2016 teaching assistant	Università degli Studi di Padova, DAFNAE General Physics (8 CFU) for the Viticulture and Enology School, 20 hours
spring 2016 lab assistant	Università degli Studi di Padova, DFA “G. Galiei” Physics Lab for the Engineering School, 24 hours
fall 2015 co-lecturer	Federazione Italiana Scuole Materne, Treviso “Scientists at the age of 2: science projects in kindergarten”, with dr. C. Tosatto, psychologist, two courses of 6 hours each
spring 2015 lecturer	Università degli Studi di Padova, DIMED General Physics (8 CFU) for the Medical School, 24 hours integration course
2008-2009 tutor	Università degli Studi di Padova study groups tutoring activity for the Engineering School, 100 hours
2005-2017	private teaching on-demand lectures to high school and undergraduate students: General Physics, Electrodynamics, Calculus, Linear Algebra and Statistics

DIVULGATION AND OUTREACH

9.2018 round table	“Ventennale della Rete L.E.S.” “Una rete per la conoscenza: fare, disfare, capire.” Part of the event series “La scienza si racconta” for the 20th anniversary of the L.E.S. school network for scientific education in Treviso.
10.2016 invited lecture	Università Popolare Circolo AUSER “il Ponte”, Maserada sul Piave “Le onde gravitazionali (spiegate ai nonni)”
10.2015, 1.2016 invited lectures	AUSER Università Popolare dei comuni dell’Asolano, Fonte “Il bosone di Higgs (spiegato ai nonni)” “Albert Einstein e la relatività cent’anni dopo”
5.2015 invited seminar	Associazione BiblioTreviso, Treviso “... a proposito del bosone di Higgs”
10.2014 invited lectures	Università Popolare Circolo AUSER “il Ponte”, Maserada sul Piave “Il bosone di Higgs (spiegato ai nonni)” “Il bosone di Higgs: un approfondimento sperimentale”
3.2014 tutor	Istituto Nazionale di Fisica Nucleare, Padova International Masterclasses 2014: Introduction to Elementary Particle Physics
fall 2010 organisation and opening lecture	Auditorium “d. E. Vidotto”, Maserada sul Piave “Cose mai viste”, exhibition about Galileo’s revolutionary contribution in Physics and Astronomy, including interactive models of laboratory experiments and astronomical observations
6.2009 invited lecture	Università Popolare Circolo AUSER “il Ponte”, Maserada sul Piave “La Fisica e il significato della scienza”
spring 2001 guide service	Palazzo dei Trecento, Treviso “Le Matematiche”, exhibition of models and instruments mainly on projective geometry and conic sections, promoted by Provincia di Treviso

SKILLS

LANGUAGES

Italian	mother tongue [C2]
English	advanced written and oral comprehension and production [C1]
French	advanced written comprehension [C1] good oral interaction and written production [B1]
Bulgarian	basic oral interaction and written comprehension [A2]

COMPUTING SKILLS

OS	familiar with Linux, Windows, OS X
coding	proficient in C++, C and Python, basic skills in Fortran 77 and shell scripting
analysis	proficient in ROOT and GNUPlot, basic skills in PAW and Matlab
simulation tools	familiar with Sentaurus TCAD, Geant4 and GATE
other	familiar with common office suites, LATEX, vector graphics, basic skills in Autocad and html

Data

18 LUGLIO 2019

Luogo

ZERO BRANCO