Curriculum Vitæ of Emanuele Di Marco

- Name: Di Marco
- First Name: Emanuele
- Born: February, 7^{th}, 1979, Roma (Italy)
- Citizenship: Italian
- Professional address (Roma): Sapienza, Univ. Roma, Piazzale A. Moro, 2, 00185 Roma (Italy)
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- Languages: Mother tongue Italian. Speaks, reads, and writes fluently English and French.

Academic Positions

Permanent reasercher ("III Livello")	INFN Roma	2015 – present
"Marie Curie" Fellow	CERN, Geneva (CH)	2014 – 2017
"Tolman" Prize Fellow	Caltech, Pasadena (USA)	2011 – 2014
Postdoctoral research associate	La Sapienza Università di Roma	2009 – 2011
INFN fellowship	CERN, Geneva (CH)	2008 – 2009
Postdoctoral research associate	La Sapienza Università di Roma	2007 – 2009

Education

Ph.D. in Physics	La Sapienza Università di Roma Thesis: *Measurements of CP violating asymmetries in charmless three-body B decays with the $BaBar$ experiment*. Supervisor Prof. F. Ferroni.	2003 – 2007
"Laurea" in Physics	La Sapienza Università di Roma Thesis: *Study of the decays $B^0 \to \phi K^0$ with the $BaBar$ experiment*, (110/110). Supervisor Prof. F. Ferroni.	1998 – 2002
Diploma	Liceo Scientifico Statale Talete, Roma (60/60)	1993 – 1998

Physics Experiments

CMS	Higgs boson physics, W and Z physics, dark matter searches, ECAL software and hardware	2007 – present
CYGNUS	TPC R&D, test-beams data analysis	2016 – present
BaBar	CP violation in $b \to s$ decays, RPC commissioner, IFR upgrade	2002 – 2007

Academic Titles

ASN	Seconda Fascia settore conc. 02/A1 Fisica Sperimentale delle interazioni fondamentali	2012 – present
Idoneità INFN	Selection for permanent researcher ("III Livello") experimental subnuclear physics	2010
Idoneità INFN	Selection for temporary researcher ("III Livello") experimental physics	2009

Teaching and tutoring Experience

- 2016–present: co-advisor of one Ph.D. thesis of CMS Roma group (M. Cipriani)
- in 2015, co-advisor of one master thesis of CMS Roma group (M. Cipriani)
- in 2016–2017, advisor of two master thesis of Trieste CMS group (A. Da Rold, J. Magro)
- in 2011–2014, advisor of 4 bachelor thesis of the Caltech group
- in 2011, advisor of one master thesis of Trieste CMS group (A. Schizzi)
- in 2005, advisor of one master thesis of Torino BaBar group (M. Pelliccioni)
- academic year 2004-2005: teaching assistant in Laboratory of Informatics for Physicists for undergraduate students at Università di Roma "La Sapienza".

Project leaderships

CMS	Rome computing center co-coord. (5 people)	2017 – present
	ECAL detector performance group (80 people)	2014 – 2017
	$H \to ZZ \to 4\ell$ analysis coordinator (20 people)	2013 – 2104
	ECAL institution board memeber (Caltech)	2013 – 2014
	Electron and photon reconstruction sub-group (20 people)	2013 – 2014
	$H \to WW$ analysis group (40 people)	2011 – 2012
	ECAL laser monitoring system (hardware)	2011 – 2014
	ECAL high voltage system	2009 – 2011
	ECAL data quality monitoring (5 people)	2009 – 2011
BaBar	Flavor b-tagging efficiencies responsible	2006
	Prompt reconstruction farm in Padova (5 people)	2006
	Tracking reconstruction task force	2005

Books

- Co-editor of the review book *Discovery of the Higgs Boson*, documenting the studies done at high energy colliders (LEP, Tevatron and LHC) for the search of the Higgs boson. Published by World Scientific in 2016 (ISBN: 978-981-4425-44-5).

Awards

- 2009: "CMS Achievement Award". Award for outstanding contribution in the CMS $ECAL$ commissioning through the development of the $ECAL$ high voltage system (hardware) and data quality monitoring (software).

Research activity

My research activity focused on the experimental high energy physics.
From 2002 to 2007 it focused on the study of CP violation in the B meson weak decays and the search of indirect signs of physics beyond the Standard Model in the flavor sector through charmless $b \to s$ decays. Measurement of the time-dependent CP violation of the B meson in three kaon decays, first in the quasi-two-body approximation [pub5, ci1, ci2], then including interference effects through the Dalitz plot [pub15, pub13, ci3, ci4, p2]. A new spin-zero resonance decaying in two charged kaons with mass around 1.55 GeV/c^2, the $X_0(1550)$, have been found as contributing to the Dalitz plot. Usage of ad hoc B production vertex measurement, based on K^0_S vertex and e^+e^- interaction point constraint [pub4, pub14]. These measurements highly constrained the presence of non Standard Model processes with large flavor violation. I have been a collaborator of $BaBar$ experiment, running at the PEP-II e^+e^- collider in the SLAC laboratory (Stanford, California), from 2002 to 2009 [s1–s4].

From 2005 to 2006 operations manager and performance studies for the muon and neutral hadron identification system of BaBar based on RPC technology (IFR). Innovative algorithms for reconstructing and identifying K^0_L particles through the combined use of electro-magnetic calorimeter (EMC) and IFR. Demonstration of the aging effects of fluoridric acid (HF) production in the gas mixture and possible mitigations of it [pub2]. This detector has shown a stable high efficiency through the entire data-taking period, also with the change of the operating mode from *streamer* to *avalanche* [pub1, pub3]. Upgrade of the barrel section of the IFR with Limited Streamer Tubes (LST).

In 2005 and 2006 responsible for the B flavour tagging efficiencies and vertexing resolution, with the measurements used by all the BaBar collaboration. In 2005, tracking studies for the recovery of the loss of efficiency in K^0_S reconstruction after the shutdown, allowing a complete recovery at the start of the new run period of BaBar.

In 2007 I joined CMS collaboration and was involved on several experimental activity regarding CMS commissioning: from 2007 to 2010 the high voltage system for the avalanche photo-diodes and development of data quality monitoring of the electro-magnetic calorimeter (ECAL) [pub19]. On the software side, developer of the online and offline ECAL Data Quality Monitoring (DQM) system, which is still in use [p4].
From 2011 to 2014 responsible of the monitoring of $PbWO_4$ crystals through a laser system, that is used to correct the continuous transparency variations due to radiation during the LHC fills.

With the very early LHC data (36 pb^{-1} at $\sqrt{s}$=7 TeV), principal author of the first measurement of the cross section for W and Z production in association to up 4 jets [pub22, cn2, ci7, p5]. With the same data, measurement of the W charge asymmetry, useful as constraints for the PDFs [pubAAA]. Contribution to the first measurement of inclusive W and Z production with the early data, with the electron channels [pubBBB, pub21, ci6, p6].

From 2008 developer of electron reconstruction and identification with the CMS early data. From 2013 to 2014 coordinator of the electrons and photons reconstruction sub-group of the EGamma physics group [pub31].

Since 2007 involved in the direct search of the Higgs boson of the Standard Model (SM) [pub24, pub27, pub26, ci8]. From 2011 to 2012 in CMS experiment analysis and convenorship of the physics group for the search of the Higgs boson with W pairs, that gave the first indication of

the 125 GeV particle, and finally contributed to its discovery [pub28]. Presented personally at the ICHEP 2012 conference in Melbourne [ci9, p9]. Proposed an analysis method to allow the mass measurement in the presence of two neutrinos up to 3% precision [pub30]. Measurements of the SM $pp \to W^+W^-$ production cross section at $\sqrt{s}$=7 and 8 TeV.
From 2012 to 2014 one of the principal authors of the Higgs search with ZZ$\to$ 4ℓ final state (on electrons optimization for the search and then on the properties measurement: mass and spin-CP [ci11]). Coordinator of the analysis group and the editor of the paper [pub31] on Run I data from 2013 to 2014 [1, 2]. Developer of an analysis technique for unfolding effective Higgs couplings from data through an 8D fit, in collaboration with theorists [pubxxx].

From 2014 to 2017 convener of the CMS ECAL Detector Performace Group (DPG) as a group convener, responsible for the optimizations of its running conditions, energy reconstruction algorithms, calibrations [pub32]. In this period I covered the transition from Run I to Run II, when LHC changed the bunch spacing from 50 to 25 ns. In 2014, main developer of the of the completely new local energy reconstruction algorithm for ECAL [ci10]. This allowed ECAL to maintain the optimal energy resolution in conditions of high pileup. The algorithm is still in use and performing well up to the unprecedented peak pileup of 60 events per bunch crossing [ci12]. It is the standard algoithm foreseen for the HL LHC phase in the ECAL barrel.

From 2015 to 2017 participated to the search of dark matter with MET plus jets in the final state with 2016 CMS data ("monojet" and invisible Higgs production), also with the supervision of a master degree student (Rome "La Sapienza") [pub33].

From 2017, author of the preparatory measurements needed for the W mass measurement (W helicity, rapidity, charge asymmetry, Z and W p_T measurements) with leptonic decays. Focus on both the experimental aspects (optimization of lepton scale up to 10^{-4} precision), theoretical aspects (PDFs, QCD and EWK uncertainties) and measurement aspects (global fitting procedure).

From 2016 I am also involved in the development of a gas TPC prototype for WIMPs detection (R&D of the detectors and data analysis of the test-beams performed in 2016 and 2017 at the BTF in Frascati).

Computing Experience

In-depth knowledge of C, C++, python, perl, shell scripting (*BASH*, *CSH*).

Bibliometric parameters

Parameters from http://inspirehep.net/ on 7 March 2018.

Citation summary results	Citeable papers	Published only
Total number of papers analyzed	1,287	1,035
Total number of citations	97,136	94,121
Average citations per paper	75.5	90.9
Breakdown of papers by citations		
Renowned papers (500+)	16	15
Famous papers (250-499)	36	36
Very well-known papers (100-249)	183	181
Well-known papers (50-99)	270	262
Known papers (10-49)	485	420
Less known papers (1-9)	228	113
Unknown papers (0)	69	8
hHEP index	143	142

Selected publications

In the following a selection of publications in refereed international journals. To each of these publications I gave a relevant contribution.

References

[*] **CMS physics papers**

[pub39] A. M. Sirunyan *et al.* [CMS Collaboration], "Search for dark matter produced with an energetic jet or a hadronically decaying W or Z boson at $\sqrt{s} = 13$ TeV," JHEP **1707**, 014 (2017)

[pub38] V. Khachatryan *et al.* [CMS Collaboration], "Performance of Photon Reconstruction and Identification with the CMS Detector in Proton-Proton Collisions at sqrt(s) = 8 TeV," JINST **10**, no. 08, P08010 (2015)

[pub37] V. Khachatryan *et al.* [CMS Collaboration], "Performance of Electron Reconstruction and Selection with the CMS Detector in Proton-Proton Collisions at s = 8 TeV," JINST **10**, no. 06, P06005 (2015)

[pub36] Y. Chen, E. Di Marco, J. Lykken, M. Spiropulu, R. Vega-Morales and S. Xie, "8D likelihood effective Higgs couplings extraction framework in $h \to 4\ell$," JHEP **1501**, 125 (2015)

[pub35] V. Khachatryan *et al.* [CMS Collaboration], "Constraints on the spin-parity and anomalous HVV couplings of the Higgs boson in proton collisions at 7 and 8 TeV," Phys. Rev. D **92**, no. 1, 012004 (2015)

[pub34] S. Chatrchyan *et al.* [CMS Collaboration], "Measurement of the properties of a Higgs boson in the four-lepton final state," Phys. Rev. D **89**, no. 9, 092007 (2014)

[33] V. Khachatryan *et al.* [CMS Collaboration], "Measurement of differential and integrated fiducial cross sections for Higgs boson production in the four-lepton decay channel in pp collisions at $\sqrt{s} = 7$ and 8 TeV," JHEP **1604**, 005 (2016)

[pub32] S. Chatrchyan *et al.* [CMS Collaboration], "Measurement of Higgs boson production and properties in the WW decay channel with leptonic final states," JHEP **1401**, 096 (2014)

[pub31] S. Chatrchyan *et al.* [CMS Collaboration], "Study of the Mass and Spin-Parity of the Higgs Boson Candidate via Its Decays to Z Boson Pairs", Phys. Rev. Lett. **110**, 081803 (2013)

[pub30] S. Chatrchyan *et al.* [CMS Collaboration], "Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC," Phys. Lett. B **716**, 30 (2012)

[pub29] S. Chatrchyan *et al.* [CMS Collaboration], "Search for the standard model Higgs boson decaying to a W pair in the fully leptonic final state in pp collisions at sqrt(s) = 7 TeV," Phys. Lett. B **710**, 91 (2012)

[pub28] S. Chatrchyan *et al.* [CMS Collaboration], "Combined results of searches for the standard model Higgs boson in pp collisions at sqrt(s) = 7 TeV," Phys. Lett. B **710**, 26 (2012)

[pub27] S. Chatrchyan *et al.* [CMS Collaboration], "Search for the standard model Higgs boson in the decay channel H to ZZ to 4 leptons in pp collisions at sqrt(s) = 7 TeV," Phys. Rev. Lett. **108**, 111804 (2012)

[pub26] S. Chatrchyan *et al.* [CMS Collaboration], "Measurement of the lepton charge asymmetry in inclusive W production in pp collisions at $\sqrt{s} = 7$ TeV," JHEP **1104**, 050 (2011)

[pub25] CMS Collaboration, "Measurement of W+W production and search for the Higgs boson in pp collisions at sqrt(s) = 7 TeV" Physics Letters B **699**, 25 (2010)

[pub24] S. Chatrchyan *et al.* [CMS Collaboration], "Inclusive search for squarks and gluinos in pp collisions at $\sqrt{s} = 7$ TeV," Phys. Rev. D **85**, 012004 (2012)

[pub23] CMS Collaboration, "Jet Production Rates in Association with W and Z Bosons in pp Collisions at sqrt(s) = 7 TeV" JHEP **1201**, 010 (2012)

[pub22] V. Khachatryan *et al.* [CMS Collaboration], "Measurements of Inclusive W and Z Cross Sections in pp Collisions at sqrt(s)=7 TeV," JHEP **1101**, 080 (2011)

[pub21] S. Chatrchyan *et al.* [CMS Collaboration], "Measurement of the Inclusive W and Z Production Cross Sections in pp Collisions at $\sqrt{s} = 7$ TeV," JHEP **1110**, 132 (2011)

[*] **CMS detector papers**

[pub20] CMS Collaboration, "Commissioning of the CMS experiment and the cosmic run at four tesla", JINST **5** (2010) T03001

[pub19] CMS Collaboration "Performance and operation of the CMS electromagnetic calorimeter" JINST **5** (2010) T03010

[pub18] CMS Collaboration " Time reconstruction and performance of the CMS electromagnetic calorimeter" JINST **5** (2010) T03011

[pub17] R. Adolphi *et al.* [CMS Collaboration], "The CMS experiment at the CERN LHC," JINST **3** (2008) S08004

[*] **BaBar physics papers**

[pub16] B. Aubert *et al.* [BABAR Collaboration], "Measurement of Time-Dependent CP Asymmetry in $B^0 \to K^0_S\pi^0\gamma$ Decays," Phys. Rev. D **78** (2008) 071102

[pub15] B. Aubert *et al.* [BABAR Collaboration], "Measurements of CP-Violating Asymmetries in the Decay $B^0 \to K^+K^-K^0$" Phys. Rev. Lett. **99**, 161802 (2007)

[pub14] B. Aubert *et al.* [BABAR Collaboration], "Measurement of CP Asymmetries in $B^0 \to K^0_SK^0_SK^0_S$ Decays", Phys. Rev. D **76**, 091101 (2007)

[pub13] B. Aubert *et al.* [BABAR Collaboration], "Observation of CP violation in $B^0 \to K^+\pi^-$ and $B^0 \to \pi^+\pi^-$," Phys. Rev. Lett. **99**, 021603 (2007)

[pub12] B. Aubert *et al.* [BABAR Collaboration], "Measurement of the CP-violating asymmetries in $B^0 \to K^0_S\pi^0$ and of the branching fraction of $B^0 \to K^0\pi^0$," Phys. Rev. D **77**, 012003 (2008)

[pub11] B. Aubert et al. [BABAR Collaboration] *"Improved measurement of CP violation in neutral B decays to $c\bar{c}s$"*, Phys. Rev. Lett. **99**, 171803 (2007)

[pub10] B. Aubert *et al.* [BABAR Collaboration], "Search for $B^+ \to \phi\pi^+$ and $B^0 \to \phi\pi^0$ decays," Phys. Rev. D **74**, 011102 (2006)

[pub9] B. Aubert *et al.* [BABAR Collaboration], "Dalitz plot analysis of the decay $B^\pm \to K^\pm K^\pm K^\mp$," Phys. Rev. D **74**, 032003 (2006)

[pub8] B. Aubert *et al.* [BABAR Collaboration], "Observation of CP violation in $B^0 \to \eta' K^0$ decays," Phys. Rev. Lett. **98**, 031801 (2007)

[pub7] B. Aubert *et al.* [BABAR Collaboration], "Search for the decay $B^0 \to K^0_sK^0_sK^0_L$," Phys. Rev. D **74**, 032005 (2006)

[pub6] B. Aubert *et al.* [BABAR Collaboration], "Observation of $B^+ \to \bar{K}^0K^+$ and $B^0 \to K^0\bar{K}^0$," Phys. Rev. Lett. **97**, 171805 (2006)

[pub5] B. Aubert *et al.* [BABAR Collaboration], "Measurement of CP asymmetries in $B^0 \to \phi K^0$ and $B^0 \to K^+K^-K^0_S$ decays," Phys. Rev. D **71**, 091102 (2005)

[pub4] B. Aubert *et al.* [BABAR Collaboration], "Branching fraction and CP asymmetries of $B^0 \to K^0_SK^0_SK^0_S$", Phys. Rev. Lett. **95**, 011801 (2005)

[*] **BaBar detector papers**

[pub3] F. Anulli *et al.*, "Performance of 2nd generation BaBar resistive plate chambers," Nucl. Instrum. Meth. A **552**, 276 (2005)

[pub2] H. R. Band *et al.*, "Study Of HF Production In BaBar Resistive Plate Chambers", Nucl. Instrum. Meth. A **594**, 33 (2008).

[pub1] H. R. Band *et al.*, "Performance and Aging Studies of BaBar Resistive Plate Chambers" Nucl. Physics B **158**, 139-142 (2006).

Other publications and selected conference reports

[*] **CMS proceedings and relevant public notes**

[p9] E. Di Marco [CMS Collaboration], "Search for SM Higgs decaying to WW $\to \ell\nu\ell\nu$ and $\ell\nu$qq at CMS", PoS ICHEP **2012**, 076 (2013)

[p8] E. Di Marco [CMS Collaboration], "Searches for the standard model Higgs boson at CMS", Il Nuovo Cimento **36**, 1 (2013)

[p7] S. Chatrchyan *et al.* [CMS Collaboration], "Measurement of W+W- and ZZ production cross sections in pp collisions at sqrt(s)=8 TeV," CERN-PH-EP-2012-376, arXiv:1301.4698 [hep-ex].

[p6] E. Di Marco [CMS Collaboration], "Observation of W and Z boson candidates with the CMS experiment", DESY-PROC-2010-01.

[p5] E. Di Marco "Measurement of W and Z production in association with jets with CMS detector" Il Nuovo Cimento **32**, 3 (2009)

[p4] E. Di Marco, "The CMS ECAL data quality monitoring and first results with cosmics data", Nucl. Physics B **197**, 267-270 (2009)

[*] **BaBar proceedings and relevant public notes**

[p3] M. Bona *et al.*, "SuperB: A High-Luminosity Asymmetric e+ e- Super Flavor Factory. Conceptual Design Report," SLAC-R **856**, INFN-AE **07-02**, LAL **07-15**

[p2] E. Di Marco [BABAR Collaboration], "Measurement of direct CP asymmetries in charmless hadronic B decays," Moscow 2006, ICHEP 843-850

[p1] E. Di Marco, "Measurement of angle β with time-dependent CP asymmetry in $B^0 \to K^+K^-K^0$ decays," proceeding for an invited talk at 4th International Workshop on the CKM Unitarity Triangle (CKM 2006), Nagoya, Japan, 12-16 Dec 2006.

International Conferences talks

[ci12] **"Role of the CMS electromagnetic calorimeter in the measurement of the Higgs boson properties"** talk at conference "Higgs Couplings 2016", SLAC - Stanford (USA), November 2016.

[ci11] **"Studies of the Higgs boson spin and parity using the gamma gamma, ZZ, and WW decay channels with the CMS detector** talk at conference "ICHEP 2014", Valencia (Spain), July 2014.

[ci10] **"CMS electromagnetic calorimeter calibration and timing performance during LHC Run I and future prospects'** talk at conference "IEEE 2014", Seattle (USA), November 2014.

[ci9] **"Search for Higgs in WW decays at CMS"** talk at conference "ICHEP 2012", Melbourne (Australia), July 2012.

[ci8] **"Higgs into WW and ZZ at CMS"** talk at conference "Higgs Hunting 2011", Paris (Fance), July 2011.

[ci7] **"V+ Jets and V+gamma at the LHC"** talk at conference "Lishep 2011", Rio de Janeiro (Brasil), July 2011.

[ci6] **"Observation of W and Z production with CMS experiment"** talk at conference "Physics at LHC 2010" Hamburg (Germany), June 2010.

[ci5] **"The CMS ECAL data quality monitoring and first results with cosmics data"** talk at conference "11^{th} Topical Seminar on Innovative Particle and Radiation Detectors", Siena (Italy), October 2008.

[ci4] **"Direct CP Asymmetries in Charmless B Decays with the BaBar experiment"** International Conference on High Energy Physics (ICHEP2006), Moscow (Russia), July 2006

[ci3] **"Measurement of CKM angle β with time dependent Dalitz plot analysis of $B^0 \to K^+K^-K^0$ decays"** IV CKM Workshop, Nagoya (Giappone), December 2006

[ci2] **"Measurement of $\sin 2\beta$ at B-factories"** Worksop Weak Interactions and Neutrinos (WIN 2005), Delphi (Grecia), June 2005

[ci1] **"Measurement of CP asymmetries in $b \to s$ decays at $BaBar$"** Annual Meeting of the American Physical Society, Tampa (FL), April 2005

Italian Conferences talks

[cn3] **"Ricerca di Higgs a CMS"** plenary talk at conference "Incontri di Fisica delle Alte Energie - XI edizione", Ferrara (Italy), April 2012.

[cn2] **"Misura di W e Z con produzione associata di jet a CMS"** talk at conference "Incontri di Fisica delle Alte Energie - VIII edizione", Bari (Italy), April 2009.

[cn1] **"Measurement of CP asymmetry in $b \to s$ decays"**, plenary talk the the "LNF spring school", Roma (Italy), April 2004

Seminars

[s5] **"Higgs searches with diboson decays with CMS experiment"** High Energy Phyisics Seminar given at California Institute of Technology, Pasadena (USA), November 2011

[s4] **"Search for new physics with time-dependent CP asymmetries in $b \to s$ transitions"** High Energy Phyisics Seminar given at University of California, San Diego (USA), December 2006

[s3] **"Search for new physics with time-dependent CP asymmetries in $b \to s$ transitions"** High Energy Phyisics Seminar given at Princeton University (USA), January 2007

[s2] **"Search for physics beyond the Standard Model at B-factories"** Seminar of Particles and Fields, Università di Roma "La Sapienza", Roma (Italy), May 2006

[s1] **"Flavour Changing Neutral Current processes in B decays"** Seminar of Particles and Fields, University of Rome "La Sapienza", Roma (Italy), November 2004