

# Marco Musich, Ph.D.

## Physicist

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### COORDINATES

**Private address:** Rue de Lyon, 7 bis – 01630 St. Genis-Pouilly (F) +33 450.202.468

**Office (while at CERN):** CERN, CH-1211 Geneve 23, Bldg. 40, 2-A16 (CH) +41 22.767.151

### PERSONAL DATA

**Birth Date:** 13<sup>th</sup> November 1983

**Citizenship:** Italian

**Birth Place:** Cirié (TO) - Italy

**Driving Licence:** B (car)

### CURRENT POSITION

2011 **Post-doctoral research fellow** *INFN – Sezione di Torino* Torino, Italy

I am carrying out my research activity in high-energy particle physics at the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) in Geneva.

My recent activity in CMS has been focused on the study of the alignment of the Inner Tracker Detector. Exploiting the experience acquired on tracking and vertexing at CMS, I have joined the *Electroweak Physics Working Group*, focusing on the measurement of the production cross-section for the process  $pp \rightarrow Z + b\text{-jets}$  ( $Z \rightarrow ll$ ). The production of the  $Z$  boson in association with *bottom* quarks is an important measurement at the LHC, both as a benchmark channel to the production of the Higgs boson in association with  $b$  quarks, and as a Standard Model background to the  $H \rightarrow ZZ$  search and to new physics searches in final states with leptons and  $b$ -jets.

### EDUCATION

2008 **Ph.D. in Physics and Astrophysics** *Università degli Studi di Torino* Torino, Italy

2011 Thesis: “*The CMS Tracker Alignment and its implications for the early quarkonium physics*” Supervisor: Dr. E. Migliore

The CMS Experiment at the LHC proton-proton collider (CERN, CH) is probing particle physics at an energy scale never reached before. To measure accurately momenta of charged particles coming out of the high energy collisions provided by LHC, the CMS experiment deploys a tracking device fully realized with silicon technology. Precise spatial alignment (at the level of few  $\mu\text{m}$ ) of the O(100k) silicon modules of the CMS Tracker is needed to reach the desired momentum resolution, and is achieved by means of statistically-based optimization algorithms. I have developed several data-driven methods to validate alignment and tested them both with cosmic-ray and collision data to assess the achieved alignment precision. Furthermore I have been responsible for the calibration of the Alignment Position Errors (*APE*) associated to the nearly hundred thousand alignment parameters. *APE* play a major role in track pattern recognition and affect heavily tracking efficiency and  $b$ -tagging of jets. I have developed a procedure based on unbiased primary vertices fitting, to assess alignment of the structures of the Pixel Tracker, which is now regular part of the monitoring of the alignment performances and of the standard validation procedure of Tracker alignment. Finally I studied the impact of potential remaining systematic misalignment on the early charmonium physics observables. I studied the effects of possible non-trivial transformations of the geometry, the so called weak modes, which leave the  $\chi^2$  of the track fits unchanged, on the measured values of the mass of the  $J/\psi$  meson, and the systematic uncertainty due to misalignment in the first measurement, in the energy regime of LHC, of the fraction of  $J/\psi$  mesons produced in the decay of  $b$ -hadrons.

- 2005 **Laurea Magistrale in Fisica (M.Sc.)** *Università degli Studi di Torino* Torino, Italy  
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- 2007 Thesis: “A study of low mass Higgs Boson decay  $H \rightarrow ZZ \rightarrow 2\mu 2e$  at the CMS Experiment” Supervisor: Dr. E. Migliore  
I developed computing skills and enhanced quantitative analysis, as well as team-working and communication skills. Specialization in Elementary Particle Physics.  
Final grade: 110/110 *magna cum laude*.
- 2002 **Laurea Triennale in Fisica (B.Sc.)** *Università degli Studi di Torino* Torino, Italy  
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- 2005 Thesis: “Study of an optical coupling device between quartz fibers and a photomultiplier for the ALICE ZDC” Supervisor: Prof. M. Gallio  
Final grade: 110/110 *cum laude*.
- 1997 **Scientific Diploma** *Liceo Scientifico G. Galilei* Ciriè, Italy  
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- 2002 Course studies included science, chemistry, physics, mathematics, Latin language and two foreign languages (English and French).  
Final grade: 100/100

## MAIN CONFERENCES & RELATIVE PUBLICATIONS

- 2010 ‘**Perspectives for Quarkonium Physics at CMS**’ **FPCP 2010**  
Poster presentation and conference proceedings Torino, Italy
- 2009 ‘**First Alignment of the CMS Tracker**’ **PIC 2009**  
Oral presentation and conference proceedings Kobe, Japan
- 2008 ‘**The CMS Silicon Strip Tracker**’ **PANIC 2008**  
Poster presentation Eilat, Israel
- 2008 ‘**The CMS Tracker Alignment with Cosmic Rays**’ **XCIV SIF National Congress**  
Oral Presentation Genova, Italy

## SKILLS

**Computational Physics:** data analysis in high-energy physics, including the development of model-based simulations. Distributed analysis on the Computing Grid (LCG). Knowledge of ROOT, Mathematica.

**Programming:** C, C++, PYTHON code development; web-oriented languages (PHP, Java), scripting languages, hypertext languages (HTML, XML, LaTeX). Experience with SQL databases.

**Computing:** Linux and the Unix shell (including bash scripting). Windows and the Office package (Word, Excel, Power Point, Front-Page). Image/sound/movie editing programs.

**Communication:** ability to summarize the results of my research in view of publications; fluency in giving presentations during international conferences and collaboration meetings.

## LANGUAGES

Native **Italian** ; excellent **English** ; fluent **French**.

## HOBBIES

Traveling, story writing, trekking, cinema.

Geneva, September 15<sup>th</sup> 2011

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