

## Cibrán Santamarina Ríos

**AREA OF INTEREST:** Particle Physics

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## Experience

*December 2011–Present: Instituto Galego de Física de Altas Enerxías (IGFAE) and Universidade de Santiago de Compostela, Santiago de Compostela, Spain.*

**Profesor Contratado Doutor, LHCb Experiment at CERN**

- Probe the Nuclear Structure in p-Pb collisions.
- Test of Lepton Flavour Universality in the analysis of B meson decays.
- Search of new physics in the analysis of charmless  $B^0$  and  $B_s$  hadronic decays.
- Study of nuclear structure in proton-ion collisions.
- Postdoc, PhD, MSc and BSc students supervision.
- Teaching Master of Science and Bachelor of Science Physics degrees.
- Representative of IGFAE in the LHC Spanish network.
- Referee for the publications committee of the LHCb experiment.

*July 2011–December 2011: Universidade de Santiago de Compostela, Santiago de Compostela, Spain.*

**Isidro Parga Pondal Fellow, LHCb Experiment at CERN**

- Search of new physics in the analysis of  $B_s$  hadronic decays.
- PhD students supervision.
- Teaching Master of Science and Bachelor of Science Physics degrees.

*January 2011–July 2011: Universidade de Santiago de Compostela, Santiago de Compostela, Spain.*

**Centro Nacional de Física de Partículas, Astropartículas y Nuclear (CPAN) Post-doctoral Researcher, LHCb Experiment at CERN**

- Search of new physics in the analysis of  $B_s$  hadronic decays.

*October 2010–January 2011: Safe Engineering Services & Technologies, Laval, QC, Canada.*

**Research Scientist**

- Development of an algorithm to segment two conducting lines according to their mutual inductance.
- Implementation of a technique to minimize the surface surrounding a sub-station grounding system.

*June 2006–June 2010: McGill University, Montreal, QC, Canada.*

**Research Associate, Physics Department, ATLAS Experiment at CERN.**

- Standard Model Higgs studies, in particular on the possibility of detecting the  $H \rightarrow b\bar{b}$  decay at the LHC.
- Potential of the  $Z + \text{jet} \rightarrow \nu\nu$  decay for calibrating the missing transverse energy.
- Author and responsible of the jet third level trigger in the experiment.
- Editor of two trigger sections of the CSC book.
- Proposer of improving methods for the first and second level jet triggers.
- Supervision of summer and undergraduate students.
- Referee for the publications committee of the ATLAS experiment.
- On-call responsible for the jet trigger system and data-taking shifter.

*March 2004–May 2006: European Laboratory for Particle Physics (CERN), Geneva, Switzerland.*

**Research Fellow, Physics Division. Trigger Group. ATLAS Experiment at CERN.**

- Responsible of the third level trigger selection of high transverse momentum electrons and photons.
- Author and responsible of the calorimeter algorithms of the third level trigger.
- Optimization for the selection of isolated electrons to detect the Higgs decay channel  $H \rightarrow ZZ \rightarrow 4e$ .
- Research Trainer at the Universidad Nacional de La Plata (Argentina).
- Coordinator of the integration, development and performance studies of the Global Monitoring System in the 2004 combined test beam.
- Supervision of summer students.
- Team member of the 2004 test beam Trigger and Data Acquisition system.

*September 2001–March 2004: Universität Basel, Basel, Switzerland.*

**Research Associate, Institut für Physik. DIRAC Experiment at CERN.**

- Study of the effect of the accidental degeneration of hydrogen-like atoms in the probability of transition between two discrete states.
- Proposer of the use of a multi-layer target in the determination of systematic errors of the experiment.
- Determination of the proportionality between the background and the pionic atoms yield.
- Description of the  $\pi^+\pi^-$  background using two targets. Analysis of the multiple scattering effects.
- Co-author of the proposal for the DIRAC extension to measure the  $\pi K$  atom lifetime. Approved by CERN.
- Major contributor to the lifetime measurement of ponium lifetime.
- Co-supervisor of PhD students.

*October 1995–December 2000: Universidade de Santiago de Compostela, Spain.*

**Pre-doctoral Fellow, Particle Physics Department. DIRAC Experiment at CERN.**

- Author of the Monte Carlo physics generator of the DIRAC experiment.
- Instrumentation work in the Vertical Hodoscopes and the Microstrip Gas Chambers subdetectors.
- Author of the High Voltage slow control of the hodoscopes in the experiment.
- Analysis of the performance of the trigger in the experiment.
- Teaching Assistance.

*October 1994–June 1995: Universidade de Santiago de Compostela, Spain.*

**Undergraduate Research Fellow, Applied Physics Department.**

- Research on GRIN wave light guides.
- Teaching Assistance.

## Education

*October 1997–April 2001: Universidade de Santiago de Compostela, Spain.*

**Doctorate Cum Laude in Particle Physics entitled: "Detection and Lifetime Measurement of ponium in the DIRAC Experiment"**

*October 1995–September 1997: Universidade de Santiago de Compostela, Spain.*

**Master in Particle Physics with Honor Mention entitled: "The Physics of Pionic Atoms".**

*October 1990–June 1995: Universidade de Santiago de Compostela, Spain.*

**Bachelor of Science in Physics, Specialized in Fundamental Physics (Atomic, Nuclear, Particles, Solid State, etc.).**

## Awards and Memberships

- *"Welcome 2 Marie Curie Senior Fellow"* FCT (Portugal) & European Union. August 2011 (declined).
- *"Isidro Parga Pondal"* contract, Xunta de Galicia (Spain). July 2011.
- Centro Nacional de Física de Partículas, Astropartículas y Nuclear (CPAN) *"Post-doctoral Researcher Fellowship"*. December 2010.
- *"Isidro Parga Pondal"* contract, Xunta de Galicia (Spain). December 2007 (declined).
- *HELEN* grant of the European Union for a stay as Research Trainer at the Universidad Nacional de La Plata (Argentina). April 2006.
- *"Research Fellow"*, European Laboratory for Particle Physics (CERN), Geneva, (Switzerland). May 2003.
- European PhD. University of Santiago de Compostela (Spain). April 2001.
- Honour Mention for the Master Thesis July 1997.
- Pre-doctoral Fellow of *"Formación de Profesorado Universitario "* (FPU). Ministry of Education and Science (Spain). October 1996.
- Pre-doctoral Fellow of *"Terceiro Ciclo"*. Xunta de Galicia (Spain). December 1995.
- Undergraduate Research Fellow (*"Colaboración"*), Ministry of Education and Science (Spain). June 1994.
- Member of the Spanish Royal Physical Society.
- Member of the European Physical Society

## Other Merits

- Participant of 17 international research projects (one as PI).
- CERN Research Associate (October-November 2017 and 2018).
- Internal referee of DIRAC, ATLAS and LHCb analyses, member of the search committee of the LHCb Spokesperson (2019), member of the search committee of the LHCb Physics Coordinator (2018).
- Invited researcher *Laboratorio de Instrumentação e Física Experimental e de Partículas* (LIP), Lisbon, Portugal, Joint Institute of Nuclear Research (JINR), Dubna, Russia and Universidad Nacional de La Plata, La Plata, Argentina.
- Local organiser of the LHCb week 2016, TWEPP 2019 and FPCP 2020.
- Member of the board of the High Energy Physics group of the Spanish Royal Physical Society (2016-2017).
- Supervised two PhDs.
- Currently supervising two PhD students.
- Three "sexenios", the last one in 2015.
- Four "quinquenios" of teaching excellence. The last one in 2017.

## Languages

- Galician and Spanish: native. English, French and Portuguese: excellent.

## Selected Publications

This a selection of most relevant and major involvement publications. For a more exhaustive list the next link can be consulted [here](#), resulting in 817 published papers and an  $h_{\text{HEP}}$  index of 130. A search in the Web of Science gives an  $h$  index of 82 (WoS ResearcherID K-4686-2014).

- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Amplitude analysis of the  $B_{(s)}^0 \rightarrow K^{0*} K^{0*}$  decays and measurement of the branching fraction of the  $B^0 \rightarrow K^{0*} K^{0*}$  decay*. JHEP 1907 (2019) 032.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Study of the  $B^0 \rightarrow \rho^0 K^{*0}$  decay with an amplitude analysis of  $B^0 \rightarrow (\pi^+ \pi^-)(K^+ \pi^-)$  decays*. JHEP05 (2019) 026.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Measurement of the inelastic  $pp$  cross-section at a center-of-mass energy of 13 TeV*. JHEP 1806 (2018) 100.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *First measurement of the CP-violating phase  $\phi_s^{dd}$  in  $B_s^0 \rightarrow (K^+ \pi^-)(K^- \pi^+)$  decays*. JHEP 03 (2018) 140.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Observation of the  $B^0 \rightarrow \rho^0 \rho^0$  decay from an amplitude analysis of  $B^0 \rightarrow (\pi^+ \pi^-)(\pi^+ \pi^-)$  decays*. Phys.Lett. B747 (2015) 468-478.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Measurement of CP violation in  $B_s \rightarrow \phi\phi$  decays*. Phys. Rev. **D 90**, 052011 (2014).
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *Measurement of polarization amplitudes and CP asymmetries in  $B^0 \rightarrow \phi K^{*0}(892)$* . JHEP **1405** (2014) 069.
- C. Santamarina, G. Aad et al. [ATLAS collaboration]. *Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC*. Phys. Lett. B **716** (2012) 1.
- C. Santamarina, G. Aad et al. [ATLAS collaboration]. *The ATLAS Experiment at the CERN Large Hadron Collider*. JINST **3** (2008) S08003.
- C. Santamarina, G. Aad et al. [ATLAS collaboration]. *The ATLAS Simulation Infrastructure*. Eur. Phys. J. C **70** (2010) 823.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *First Evidence for the Decay  $B_s \rightarrow \mu^+ \mu^-$* . Phys. Rev. Lett. **110** (2013) 021801.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *First observation of the decay  $B_s^0 \rightarrow K^{0*} K^{0*}$* . Phys. Lett. B **709** (2012) 50.
- C. Santamarina, R. Aaij et al. [LHCb collaboration]. *First observation of the decay  $B_s^0 \rightarrow \phi K^{0*}$* . JHEP **1311** (2013) 092.
- DM Asner, S Dejong, M Cunningham, K Randriarivony, C Santamarina and M Schram. *Prospects for observing the standard model Higgs boson decaying into  $b\bar{b}$  final states produced in weak boson fusion with an associated photon at the LHC*. Phys Rev. **D82**, 093002 (2010).
- JL López-Fontán, C. Santamarina and F. Sarmiento. *New considerations of the Poisson-Boltzmann equation*. Physica A 377 (2007) 15-23.
- C. Santamarina et al. [ATLAS TDAQ]. *Implementation and Performance of the Seeded Reconstruction for the ATLAS Event Filter Selection Software*. IEEE Transactions on Nuclear Science, Volume 53, Issue 3, Part 1 (2006) 864.
- C. Santamarina, B. Adeva et al. [DIRAC collaboration]. *First Measurement of the  $\pi^+ \pi^-$  Atom Lifetime*. Physics Letters **B619** (2005) 50.
- L. Afanasyev, C. Santamarina, A. Tarasov and O. Voskresenskaya. *Dynamics of the Pionium with the Density Matrix Formalism*. Journal of Physics B**37** 4749.
- C. Santamarina, M Schumann, L G Afanasyev and T Heim. *A Monte Carlo Calculation of Pionium break-up probability with different sets of Pionium Target Cross Sections*. Journal of Physics B**36** 4273.
- C. Santamarina, B. Adeva et al. [DIRAC collaboration]. *Detection of  $\pi^+ \pi^-$  atoms with the DIRAC spectrometer at CERN*. Journal of Physics G**30** 1929.
- C. Santamarina, B. Adeva et al. [DIRAC collaboration]. *A High Resolution Spectrometer for Pionium Detection*. Nuclear Instrum. and Methods Phys. Res. A**515** 467 (2003).
- C. Santamarina and J.J. Saborido. *An implementation of Atomic Form Factors*. Computer Physics Communications 151 79 (2003).
- C. Santamarina, B. Adeva et al. *The Time of Flight Detector of the DIRAC Experiment*. Nucl. Instrum. Methods Phys. Res. A 491 4 (2002).
- F. Gómez, C. Santamarina et al. *Performance of MSGC with Analog Pipeline Readout*. Nucl. Instrum. Methods Phys. Res. A 384 351 (1997).

## Conferences, Workshops, Seminars

- CP violation and mixing in beauty with LHCb. XXIX International Symposium on Lepton Photon Interactions at High Energies 2019. Toronto [Canada] (2019).
- LHCb Highlights. Second joint Workshop IGFAE/LIP. IGFAE-Auditorio Abanca, Santiago de Compostela [Spain] 2019.
- CP Violation with Charmless Vector-Vector Decays. X CPAN days. days. Centro Nacional de Física de Partículas, Astropartículas y Nuclear, Salamanca [Spain] (2018).
- Anomaly Recap. 2<sup>nd</sup> Red LHC Workshop. CIEMAT. Madrid [Spain] (2018).
- LHCb Highlights. First joint Workshop IGFAE/LIP. Universidade do Minho-Braga [Portugal] (2018).
- B Physics Summary results. XLVI International Meeting on Fundamental Physics. Salamanca [Spain] (2018).
- Charmless P to VV decays. IX CPAN days. Centro Nacional de Física de Partículas, Astropartículas y Nuclear, Santander [Spain] (2017).
- Flavor Physics. International Summer School on High Energy Physics (TAE 2017). IFAE. Benasque [Spain] (2017).
- Charmless B decays: 2body and B→VV. 15<sup>th</sup> International Conference on B-Physics at Frontier Machines (Beauty 2014). University of Edinburgh, Edinburgh [UK] (2014).
- Studies of charmless B decays. First Large Hadron Collider Physics Conference. Hotel Catalonia Barcelona Plaza, Barcelona [Spain] (2013).
- New results in B-physics. Fourth International Workshop on Prospects for Charged Higgs Discovery at Colliders. Uppsala University, Uppsala [Sweden] (2012).
- LHCb Summary Talk. III CPAN Days, Centro Nacional de Física de Partículas, Astropartículas y Nuclear, Hotel Catalonia Barcelona Plaza, Barcelona [Spain] (2011).
- Search for New Physics in Hadronic Decays of B meson at the LHCb Experiment. Invited Seminar LIP (Laboratório de Instrumentação e Física Experimental de Partículas). LIP, Lisbon [Portugal] (2011).
- Commissioning of the ATLAS Electron and Photon Trigger Selection. Poster at the Hadron Collider Physics Symposium. Toronto [Canada] 2010.
- Why do we need Higgs or something else? McGill Master Class Invited Seminar. McGill University, Montreal [Canada] 2010.
- Prospects for the Discovery of a Standard Model Higgs Boson Produced via Vector Boson Fusion and Decaying to bb in Association with a Central Photon. Seminar. Universidade de Santiago de Compostela, Santiago de Compostela [Spain] 2009.
- Improvement of L1 and L2 Jet Trigger with Numerical Inversion. Presentation. ATLAS-Canada Workshop University of Toronto, Toronto [Canada] 2009.
- Prospects for the Discovery of a Standard Model Higgs Boson Produced via Vector Boson Fusion and Decaying to bb in Association with a Central Photon. Poster Hadron Collider Physics Symposium. Evian [France] 2009.
- Invisible Z+Jet→vv detection with ATLAS early data (200 pb<sup>-1</sup>). Seminar. LIP (Laboratório de Instrumentação e Física Experimental de Partículas). LIP, Lisbon [Portugal] 2009.
- Improvement of the ATLAS jet selection using first level trigger jets at the second trigger level. Presentation: ATLAS-Canada Physics Workshop (Jasper). University of Alberta [Canada] 2008.
- HLT/Trigger jets. Presentation and co-chairing of the session. 4th ATLAS Hadronic Calibration Workshop University of Arizona, Tucson [USA] 2008.
- Measurement of ponium ( $\pi^+ \pi^-$  hydrogen-like state) lifetime to test low energy QCD predictions. Seminar. Experimental HEP and Astroparticle Physics Wednesday Meetings. McGill University, Montreal [Canada] 2007.
- Trigger Slices Overview. Presentation. 6th ATLAS-Canada Physics Workshop. University of Regina [Canada] 2007.
- Trigger Algorithms & Performance. Presentation. First ATLAS Physics Workshop of the Americas. Stanford Linear Accelerator Complex (SLAC) [USA] 2007.
- Studies on the Trigger Jet Slice performance with ttbar events. Presentation. ATLAS Trigger & Physics Week. CERN, Geneva [Switzerland] 2007.

- High Level Trigger. Presentation. 5th ATLAS-Canada Physics Workshop. University of Toronto [Canada] 2007.
- Status and commissioning plans for HLT. Presentation. Third North American ATLAS Physics Workshop Boston University [USA] 2006.
- The ATLAS Trigger. Presentation. ATLAS Canada Physics Workshop. Carleton University, Ottawa [Canada] 2006.
- Overview of  $e/\gamma$  trigger performance using Rome data. Oral Presentation. ATLAS Trigger & Physics week. CERN, Geneva [Switzerland] 2006.
- Implementation of the ATLAS High Level Trigger Software and Tools for its Performance Optimization. Performance Optimization. Presentation. 4<sup>th</sup> Conference on Computing in High Energy and Nuclear Physics. Mumbai [India] 2006.
- The ATLAS strategy for Higgs detection. Seminar. Montréal Joint HEP Seminar-McGill University-Iniversité de Montréal. Montreal [Canada] 2005.
- Selecting events to detect Higgs with the ATLAS detector. Seminar. Southern Methodist University. Dallas [USA] 2005.
- Implementation and Performance of the Seeded Reconstruction for the ATLAS EVENT FILTER Selection Software. Poster. 14th IEEE-NPSS Real Time Conference. Stockholm [Sweden] 2005.
- Detection and Lifetime Determination of Pionium in DIRAC, a Review. Seminar: EP Seminar. CERN, Geneva [Switzerland] 2004.
- Gatherer and Offline Monitoring. Presentation. ATLAS TDAQ Workshop: INFN, Frascati [Italy] 2004.
- The Pion-Pion Scattering Lengths from DIRAC. Presentation: Xth International Conference on Hadron Spectroscopy [HADRON 03] Aschaffenburg [Germany] 2003.
- On the Influence of Low  $n$  and High  $n$  States Cross Section in the Break-up Probability of Pionium. Presentation: International Workshop on Hadronic Atoms [HadAtom02]. CERN, Geneva [Switzerland] 2002.
- DIRAC PS-212. An Experiment to Measure Pionium Lifetime. Poster: XIVth Rencontres de Blois. Blois [France] 2002.
- DIRAC (PS-212) Experiment at CERN. Presentation: International Workshop on Hadronic Atoms [HadAtom01]. Bern University [Switzerland] 2001.
- Cálculo de la Probabilidad de Ruptura del Pionium por Monte Carlo. Presentation: XXVIII Reunión de la Real Sociedad Española de Física. Seville [Spain] 2001.