

ALL. B

Decreto Rettore Università di Roma “La Sapienza” n 2189/2020 del 31 Agosto 2020

GIACOMO ARTONI

Curriculum Vitae

Part I – General Information

Full Name	Giacomo Artoni
Spoken Languages	Italian (native speaker), English (near native,C2), French (proficient,B2)

Part II – Education

Type	Year	Institution	Notes (Degree, Experience,...)
PhD	2013	Università di Roma “La Sapienza”	
MS Degree	2009	Università di Roma “La Sapienza”	110/110 cum Laude
BS Degree	2007	Università di Roma “La Sapienza”	110/110 cum Laude
Summer Student	2008	Fermilab (CDF Experiment)	

Part III – Appointments

III A – Academic Appointments

Start	End	Institution	Position
Sept. 2015	Present	University of Oxford	Postdoctoral Research Assistant
Mar. 2013	Aug. 2015	Brandeis University	Postdoctoral Research Assistant

III B – Other Appointments

Start	End	Institution	Position
Oct. 2019	Present	ATLAS Experiment	Convener: Muon Combined Performance group (~50 people)
Apr. 2017	Mar. 2018	ATLAS Experiment	Sub-convener: H→ZZ group (~50 people)
Aug. 2014	Apr. 2016	ATLAS Experiment	Sub-convener: Muon Momentum Calibration group (~10 people)
Oct. 2018	Present	ATLAS Experiment	Analysis contact: H→μμ search (~30 people)
Feb. 2017	Mar. 2017	ATLAS Experiment	Analysis contact: H→ZZ→2l2ν search (~20 people)
Jun. 2014	Mar. 2017	ATLAS Experiment	Group liaison: Muon Combined Performance → Higgs
Nov. 2015	Mar. 2017	ATLAS Experiment	Group liaison: Muon Combined Performance → Exotics
Sept. 2017	Feb. 2018	Physics Letters B	Reviewer: Phys. Lett. B 780 (2018) 501

Nov. 2016	Mar. 2018	ATLAS Experiment	Paper editor: Eur. Phys. J. C 78 (2018) 4, 293 [arXiv:1712.06386 [hep-ex]]
May 2015	Sept. 2016	ATLAS Experiment	Paper editor: Phys. Lett. B 761 (2016) 372-392 [arXiv:1607.03669 [hep-ex]]
Nov. 2016	Aug. 2017	ATLAS Experiment	Editorial Board Member: Phys. Rev. Lett. 119 (2017) 051802 [arXiv:1705.04582[hep-ex]]

Part IV – Teaching experience

IV A – Courses at the University of Oxford

At the University of Oxford postdoctoral associates are normally not allowed to teach classes, since their role is to focus completely on research. However, given my expertise in Machine Learning and computational methods, and my ability to supervise students in their research activities, I was asked to teach a cycle of lectures each year (starting from 2018) to first-year DPhil students, entitled “Computational Methods in Particle Physics”.

Year	Institution	Lecture/Course
2018/2019	University of Oxford	Computational Methods in Particle Physics
2019/2020	University of Oxford	Computational Methods in Particle Physics

IV B – Student Supervision

My role, now at the University of Oxford and in the past at Brandeis University, is to perform research in the ATLAS Experiment while being based at CERN. In the course of this activity, I acted as co-supervisor of several students, with a responsibility to provide technical support and to participate in the choice of the thesis topic.

Year	Institution	Student
2019- Present	University of Oxford	Siyuan Yan
2018- Present	University of Oxford	Yingjie Wei
2016-2020	University of Oxford	Miha Zgubic (now Research Engineer at Invenia Labs)
2016-2018	University of Oxford	Luigi Vigani (now Research Associate at University of Heidelberg)
2015-2018	University of Oxford	Luigi Marchese (now Research Associate at ETH Zurich)
2015-2018	University of Oxford	Mariyan Bozhidarov Petrov (now Digital Consultant at Siemens Advanta)
2015-2016	Brandeis University	Hannah Elizabeth Herde (now Research Associate at SLAC)

Part V - Society memberships, Awards and Honors

Year	Title
2008 - 2013	INFN Associate
Aug. 2011 - July 2012	CERN associate (INFN simifellow)
2010	XCVI Congresso Nazionale della Società Italiana di Fisica, 2nd best communication, Nuclear and Sub- nuclear Physics section

Part VI - Funding Information [grants as PI-principal investigator or I-investigator]

Please note that the following is an ongoing application for which I passed all the stages of review (including the interview) and I am currently held on the reserve list.

Year	Title	Program	Grant value
2020	The Royal Society: University Research Fellowships 2020 (held on reserve list at the moment)	Precision measurements of Higgs boson properties: a powerful probe for physics beyond the Standard Model	£726,312.01

Part VII – Seminars, Conference Talks, Workshops and Schools

VII A – Seminars

Search for $H \rightarrow \mu\mu$ at ATLAS	CERN-LHC Seminar, 2020
The Higgs golden channel in ATLAS: Run 1 results of the $H \rightarrow Z Z \rightarrow 4l$ channel	LPPC Seminar, Harvard University, 2013
The Higgs golden channel in ATLAS: Run 1 results of the $H \rightarrow Z Z \rightarrow 4l$ channel	Lunchtime Seminar, Massachusetts Institute of Technology, 2013

VII B – Talks at Conferences

Combined Higgs boson measurements at the ATLAS experiment	Pheno 2019, Pittsburgh 2019
Searches for new phenomena in leptonic final states using the ATLAS detector	EPSHEP 2017, Venice 2017
Differential distributions: ATLAS + CMS	Higgs Couplings, Torino 2014
Standard Model Higgs searches in 4 leptons at ATLAS	Rencontres du Vietnam 2012, Qui Nhon 2012
Study of the Performance of the 2nd Level Muon Trigger of the ATLAS Experiment	XCVI Congresso Nazionale della Società Italiana di Fisica, Bologna 2010

VII C – Workshops

Main organiser: $H \rightarrow ZZ$ workshop	University of Oxford, April 2018
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Part VIII – Research Activities

While describing my research activity, I will also highlight my specific contributions to the twelve publications listed at the end and chosen for this application. They will be referenced as [1],[2],etc.

Keywords	Brief Description
Muon Reconstruction <i>Oct. 2013 - Present</i>	<p>I participated in the study and improvement of the muon reconstruction performance in ATLAS in the past 7 years. I served as liaison to two physics groups (Higgs and Exotics), as sub-convener of the “Momentum Calibration” subgroup and I am currently the convener of the Muon Combined Performance group. My work can be summarised as follows:</p> <ul style="list-style-type: none"> - Precise determination of muon momentum scale and resolution in data and simulation, one of the fundamental ingredients of the papers listed as [2] and [4] (using different datasets). This measurement is also a crucial ingredient of the Higgs mass measurement with the $H \rightarrow ZZ \rightarrow 4l$ decay channel, performed with different datasets from the LHC and published in [1] and [10]. - Development of a dedicated selection for highly energetic muons ($p_T > 200$ GeV). This is an important ingredient in [4] and a great improvement for searches of exotic particles. In particular, it was one of my main contributions to [5].
$H \rightarrow \mu\mu$ coordinator <i>Oct. 2018 - Present</i>	<p>Starting from October 2018 I have been chosen to coordinate the $H \rightarrow \mu\mu$ analysis team, which is composed of 40 people. The group has recently finalised the analysis of the entire Run 2 ATLAS dataset, and the resulting paper has been submitted to Phys. Lett. B (arXiv:2007.07830 [hep-ex]).</p> <p>With respect to the previous ATLAS result the expected sensitivity has been increased by 25%, thanks to improvements introduced under my coordination, namely the use of advanced taggers based on machine learning techniques for the definition of the categories and a refined strategy for the background modelling.</p>
$H \rightarrow ZZ$ convener <i>Apr. 2017 - Mar. 2018</i>	<p>Starting from April 2017 I have been appointed as convener for the $H \rightarrow ZZ$ group, which consists of about 100 people and covers many interesting analysis, all of them using either the $4l$ or the $ll + \nu\nu$ final state.</p> <p>Under my coordination the group has been highly productive as we published results for six different analyses, ranging from the measurement of differential cross sections [6], couplings [9] and mass [10] of the Higgs boson with the $H \rightarrow ZZ \rightarrow 4l$ channel, to a search for high-mass scalars with the $4l$ or the $ll + \nu\nu$ final states [8] and a search for an invisibly decaying Higgs in association with a Z boson [7], as well as a measurement of the four-lepton invariant mass spectrum [12].</p> <p>In all the aforementioned analyses I had a central role in the design of the analysis techniques to be employed, in coordinating the analysis teams and in ensuring very high-quality standards in the publications.</p>

<p>Search for a heavy Higgs boson with the $\ell\ell + \nu\nu$ final state <i>Sept. 2015 - Mar. 2017</i></p>	<p>I introduced several improvements in the analysis of this final state: I developed a dedicated event categorisation to set limits on the VBF production cross section, and I used $\gamma + \text{jets}$ events to estimate the reducible background coming from $Z + \text{jets}$ events, which is one of the most difficult to model with simulation. These additions were key ingredients in the results published with this channel, both for what regards the search for heavy resonances [8] and the search of an invisibly decaying Higgs [7].</p>
<p>Exotic dilepton search <i>June 2014 - June 2016</i></p>	<p>One of the most interesting results of the ATLAS Collaboration is the search for a heavy, narrow resonance decaying into a pair of opposite charged leptons. This type of resonance, usually denoted as Z', is predicted by many extensions of the SM (including Technicolor and extra-dimensions models), and represents one of the most promising searches at the LHC. I contributed to these results with both my electron and muon expertise, as well as by deriving limits on the observed cross section. Thanks to these contribution I was appointed as editor of the preliminary results presented at the end of 2015 (ATLAS- CONF-2015-070) as well as of the final results included in a paper [5].</p>
<p>Dark Matter search: mono-b <i>May 2013 - Oct. 2014</i></p>	<p>I performed a Dark Matter search at the LHC which requires pair production of weakly interacting massive particles (WIMPs) in association with a b-tagged jet. Such an analysis, usually referred to as mono-b, is expected to give better limits than the standard mono-jet analysis for scalar operators representing the interaction of WIMPs with SM particles. This work was published as a white paper as part of the U.S. Particle Physics Community Study Snowmass 2013. The paper includes the prospects for the mono-b search both at the HL-LHC and at future hadron colliders. The analysis was also performed on the $\sqrt{s} = 8$ TeV ATLAS dataset and lead to a publication in 2014 (Eur. Phys. J. C, 75:92).</p>
<p>Couplings measurement in the $H \rightarrow ZZ \rightarrow 4\ell$ channel <i>Mar. 2013 - Aug. 2014</i></p>	<p>I had a strong role in the measurement of the Higgs couplings in the $H \rightarrow ZZ \rightarrow 4\ell$ decay channel. I developed a multivariate discriminant to enhance the separation between the vector boson fusion (VBF) and the gluon fusion (ggF) production mechanisms by exploiting their different jet kinematics. The usage of this discriminant allowed us to reduce by a factor of two the statistical uncertainty on the VBF coupling measurement. As a result of this achievement, I was asked to coordinate the coupling measurement in the $H \rightarrow ZZ \rightarrow 4\ell$ channel. This effort culminated in the Run 1 legacy publication [3].</p>
<p>Search for a Standard Model Higgs boson with the $H \rightarrow ZZ \rightarrow 4\ell$ channel <i>Nov. 2009 - Feb. 2013</i></p>	<p>My PhD thesis was focused on the search for the Higgs boson in the decay channel $H \rightarrow ZZ \rightarrow 4\ell$. First of all, I worked on the extension of the analysis to Higgs boson masses below 140 GeV, both by optimising the kinematic selections and by improving the performance of electron reconstruction at low energies (< 15 GeV). In particular, I developed a set of identification criteria (called <i>MultiLepton</i>) for GSF electrons that has been used by the $H \rightarrow ZZ \rightarrow 4\ell$ analysis in the discovery paper (Phys. Lett. B, 716:1) and has improved by $\sim 10\%$ the sensitivity in the electron channels. I also performed the estimation of the reducible background for the electron channels by developing a new methodology, usually referred to as $3\ell + X$. This technique was then a key ingredient of [1] and [3], and is now the baseline background estimation method by analyses using the $H \rightarrow ZZ \rightarrow 4\ell$ channel.</p>

Electron reconstruction <i>Sept. 2011 - Apr. 2012</i>	<p>During 2011 a new electron reconstruction algorithm based on a Gaussian Sum Filter (GSF) has been introduced in ATLAS, to account for energy losses due to bremsstrahlung. I performed a complete validation of this new reconstruction approach in order to ensure good performance of GSF electrons (ATLAS-CONF-2012-047). Thanks to this work, GSF electrons have been used in the $H \rightarrow ZZ \rightarrow 4l$ channel for the analysis of the data recorded in 2011 and have become the baseline electrons in ATLAS since 2012.</p>
Inclusive Z cross section measurement <i>Nov. 2010 - Sept. 2011</i>	<p>This is the first measurement I contributed to during my PhD: I developed a method to estimate the QCD background in the $Z \rightarrow \mu\mu$ channel, exploiting calorimeter deposits as well as additional tracks reconstructed around the muon trajectory. The same methodology has been used in the Z boson production cross section measurement associated with jets, that has resulted in a publication (Phys. Rev. D, 85:032009).</p>
Level-2 muon trigger <i>Nov. 2010 - Sept. 2011</i>	<p>As part of my MS thesis and of my PhD I worked on the ATLAS level-2 muon trigger algorithms called μComb and μIso, which provide the first measurement of the muon kinematics as well as a first isolation selection. I tuned the algorithms for the Run 1 data-taking and I also participated in their commissioning. I reported on the performance of the whole second level muon trigger chain at the 96th SIF Congress in 2010 (Nuovo Cim., C034N5:19–27). This work has been awarded the prize for 2nd best communication in the Nuclear and Subnuclear section.</p>

Part IX – Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Papers [international]	930	Scopus	2010	2020

Total Impact factor	4829
Total Citations	46865
Average Citations per Product	50.39
Hirsch (H) index	98
Normalized H index*	9.8

*H index divided by the academic seniority.

Part X– Selected Publications

[1]

Title: *Measurement of the Higgs boson mass from the $H \rightarrow \gamma\gamma$ and $H \rightarrow ZZ^* \rightarrow 4l$ channels in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICAL REVIEW D **Journal IF:** 4.557 (2016), 3.91 (5 year)

Volume: 90 **Issue:** 5 **Article Number:** 052004

DOI: 10.1103/PhysRevD.90.052004

Published: SEP 9 2014

Citations: 149

[2]

Title: *Measurement of the muon reconstruction performance of the ATLAS detector using 2011 and 2012 LHC proton–proton collision data*

Authors: The ATLAS Collaboration

Journal: EUROPEAN PHYSICAL JOURNAL C **Journal IF:** 5.297 (2016), 4.744 (5 year)

Volume: 74 **Article Number:** 3130

DOI: 10.1140/epjc/s10052-014-3130-x

Published: NOV 26 2014

Citations: 182

[3]

Title: *Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICAL REVIEW D **Journal IF:** 4.557 (2016), 3.91 (5 year)

Volume: 91 **Issue:** 1 **Article Number:** 012206

DOI: 10.1103/PhysRevD.91.012006

Published: JAN 16 2015

Citations: 114

[4]

Title: *Muon reconstruction performance of the ATLAS detector in proton–proton collision data at $\sqrt{s}=13$ TeV*

Authors: The ATLAS Collaboration

Journal: EUROPEAN PHYSICAL JOURNAL C **Journal IF:** 5.297 (2016), 4.744 (5 year)

Volume: 76 **Article Number:** 292

DOI: 10.1140/epjc/s10052-016-4120-y

Published: MAY 23 2016

Citations: 254

[5]

Title: *Search for high-mass new phenomena in the dilepton final state using proton–proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICS LETTERS B **Journal IF:** 4.807 (2016), 4.327 (5 year)

Volume: 761 **Pages:** 372-392

DOI: 10.1016/j.physletb.2016.08.055

Published: OCT 10 2016

Citations: 50

[6]

Title: *Measurement of inclusive and differential cross sections in the $H \rightarrow ZZ^* \rightarrow 4l$ decay channel in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: JOURNAL OF HIGH ENERGY PHYSICS **Journal IF:** 6.063 (2016), 4.992 (5 year)

Issue: 2017 **Article Number:** 132

DOI: 10.1007/JHEP10(2017)132

Published: OCT 19 2017

Citations: 12

[7]

Title: *Search for an invisibly decaying Higgs boson or dark matter candidates produced in association with a Z boson in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICS LETTERS B **Journal IF:** 4.807 (2016), 4.327 (5 year)

Volume: 776 **Pages:** 318-337

DOI: 10.1016/j.physletb.2017.11.049

Published: JAN 10 2018

Citations: 44

[8]

Title: *Search for heavy ZZ resonances in the $\ell+\ell-\ell+\ell-$ and $\ell+\ell-\nu\nu^-$ final states using proton–proton collisions at $\sqrt{s}=13$ TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: EUROPEAN PHYSICAL JOURNAL C **Journal IF:** 5.297 (2016), 4.744 (5 year)

Volume: 78 **Article Number:** 293

DOI: 10.1140/epjc/s10052-018-5686-3

Published: APR 11 2018

Citations: 55

[9]

Title: *Measurement of the Higgs boson coupling properties in the $H \rightarrow ZZ^* \rightarrow 4\ell$ decay channel at $\sqrt{s}=13$ TeV with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: JOURNAL OF HIGH ENERGY PHYSICS **Journal IF:** 6.063 (2016), 4.992 (5 year)

Issue: 2018 **Article Number:** 95

DOI: 10.1007/JHEP03(2018)095

Published: MAR 15 2018

Citations: 22

[10]

Title: *Measurement of the Higgs boson mass in the $H \rightarrow ZZ^* \rightarrow 4\ell$ and $H \rightarrow \gamma\gamma$ channels with $\sqrt{s}=13$ TeV pp collisions using the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICS LETTERS B **Journal IF:** 4.807 (2016), 4.327 (5 year)

Volume: 784 **Pages:** 345-366

DOI: 10.1016/j.physletb.2018.07.050

Published: SEP 10 2018

Citations: 40

[11]

Title: *Constraints on off-shell Higgs boson production and the Higgs boson total width in $ZZ \rightarrow 4\ell$ and $ZZ \rightarrow 2\ell 2\nu$ final states with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: PHYSICS LETTERS B **Journal IF:** 4.807 (2016), 4.327 (5 year)

Volume: 786 **Pages:** 223-244

DOI: 10.1016/j.physletb.2018.09.048

Published: NOV 10 2018

Citations: 25

[12]

Title: *Measurement of the four-lepton invariant mass spectrum in 13 TeV proton-proton collisions with the ATLAS detector*

Authors: The ATLAS Collaboration

Journal: JOURNAL OF HIGH ENERGY PHYSICS **Journal IF:** 6.063 (2016), 4.992 (5 year)

Issue: 2019 **Article Number:** 48

DOI: 10.1007/JHEP04(2019)048

Published: APR 5 2019

Citations: 3

Luogo e data

Saint Genis Pouilly, 30 Settembre 2020

Firma.....

