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Education

Jan 2007	Ph.D. in Physics at Università degli Studi di Roma *La Sapienza*, Rome, Italy. Thesis title: *"First observation of B_s mixing at the CDF II experiment with a newly developed Opposite Side b flavour tagger using Kaons"*, (Prof. C. Dionisi and Dr. M. Rescigno)
Sep 2003	B.S. and M.S. ("Laurea in Fisica") at Università degli Studi di Roma *La Sapienza*, Rome, Italy. Thesis title: *"Study of the resolution of the Time-Of-Flight detector for the Fermilab CDF experiment"*, (Prof. C. Dionisi and Dr. S. Giagu, marks: 110/110)

Employment history

Apr 2017 - present	Associate Professor at Roma Tre University (Italy), based in Rome
Apr 2014 - Mar 2017	Lecturer at Roma Tre University (Italy), based in Rome
Apr 2011 - Mar 2014	Research Associate at Queen Mary, University of London (UK), based in London
Mar 2008 - Feb 2011	Post-doctoral staff at NIKHEF (The Netherlands), based at CERN, Geneva, Switzerland
Jan 2007 - Feb 2008	Research Associate at the University of Washington (USA), based at CERN, Geneva, Switzerland

Scientific responsibilities and roles

Jul 2020 - present	L3 for liquid argon FE electronics, LEGEND-1000 project
Jul 2019 - present	Principal Investigator LEGEND group at Roma Tre
Oct 2018 - Jul 2019	Member of the internal JUNO committees for the final review of the Top Tracker mechanics and the preliminary review of the Top Tracker electronics;
Mar 2017 - Jul 2019	Simulation coordinator for the Small PMT group of the JUNO experiment;
Aug 2016 - Jul 2019	Member of the internal JUNO committee for the review of the software readiness;
Aug 2016 - Jul 2019	L3 (coordinator) of JUNO experiment physics validation and MC sample production, validating the output of the simulation and reconstruction and coordinating the production of large simulations for detector, calibration and physics studies;
Mar 2016 - Dec 2019	physics and software coordinator of the Italian collaboration in the JUNO experiment;
Apr 2016 - Sep 2016	representative of the ATLAS Level-1 Muon barrel trigger at the Trigger Menu coordination group;
Dec 2013 - Aug 2015	Editor in charge of the publication and convener of the analysis team for the search for the associated production of Higgs bosons and top quarks in a specific final state (with many electrons and muons);
Jul 2011 - Sep 2012	Convener of the ATLAS Top quark Reconstruction working group. The group's work consists of studying the performance and calibrations of all the building blocks of analysis (lepton ID, jets, Missing Energy, b-jet ID) in the context of top quark decays. The group's goals are: optimization all the object selections, assessment of the effect of efficiency and energy scaling *in-situ* on top events and provision of procedures to evaluate the systematic uncertainties. All ATLAS Top quark analysis (published and preliminary) follow the group's official recommendations and inputs. The group includes about 40 people from several different universities world-wide.
Jun 2013 - Oct 2013	Coordinator of the ATLAS $H \to WW$ sub-group on top quark background.
Jun 2012 - May 2013	Convener of the ATLAS Top UK national group which brings together all the British analysis teams involved in Top quark physics. The position also encompasses the vetting of material to be shown at national conferences in the UK
Oct 2011 - Jul 2013	Member of the Local Organizing Committee of the TOP2012 conference and Chief Editor of the conference proceedings (J. Phys. Conf. Ser. 452 (2013), http://iopscience.iop.org/1742-6596/452/1)
Aug 2012 - Jun 2019	Internal reviewer for ATLAS conference proceedings
2009 - 2011	Coordinator of the Top quark Working Group sub-group optimizing the muon selections for all Top quark analysis, both at the trigger level and offline; the group includes about 10 people from different institutions.
Winter-Summer 2011	Main editor of notes on lepton selection, efficiency and scale factor determination used in the $t\bar{t}$ cross-section measurements for 2011 winter and summer conferences.
Winter 2011	Main editor of the note on the cross-section measurement using kinematic fit and b-tagging (for 2011 winter conferences).

Academic responsibilities and roles

Jul 2022 - present	Member of Collegio di Dottorato at Roma Tre
Mar 2022 - present	Member of the Teaching Committee for physics (Commissione Didattica di Fisica) at the Department of Mathematics and Physics at Roma Tre
Sep 2019 - Feb 2022	Erasmus+ Coordinator for physics at Roma Tre.
Jul 2018	Member of the Selection Committee for the PhD in accelerator physics at Università degli Studi di Roma *La Sapienza*.
Nov 2014 - present	Member of the Student-Staff joint committee (Commissione Paritetica) of the Department of Mathematics and Physics at Roma Tre
Sep 2016 - Jan 2019	Member of the Teaching Committee for physics (Commissione Didattica di Fisica) at the Department of Mathematics and Physics at Roma Tre

Refereeing

Sep 2019 - Present	Referee, EPJ C journal.
Mar 2012	Invited referee of the "Electroweak model and constraints on new physics" section of the Particle Data Group "Review of Particle Physics" for 2012 (Phys. Rev. D86, 010001 (2012)).

Awards and fellowships

2013	Winner of the Italian "Rita Levi Montalcini" fellowship awarded to outstanding junior faculty working abroad to take on an academic position in Italy, endowed with a personal 3-year start-up research budget. The committee selected 24 candidates from all fields of science.
2003 – 2006	Scholarship accompanying my PhD courses, assigned by the Department of Physics, Università degli Studi di Roma *La Sapienza*.

Student Supervision

2022-present, Roma Tre	supervision several bachelor theses on LEGEND
2020-present, Roma Tre	N. Burlac (Ph.D. student): LAr veto and first analysis of $0\nu2\beta$ with LEGEND-200
2019-2021, Roma Tre	D. Liberati (Master student): study of muon-induced backgrounds in liquid argon for an on-line veto system for the LEGEND-200 experiment.
2018-2021, Roma Tre	L. Martinelli (Ph.D. student): measurement of the top quark mass in the di-lepton final state with leptonic only variable. Uses LHC Run 2 data with the ATLAS detector.
2018, Roma Tre	D. Tulli (Bachelor student): validation of MET in ATLAS.
2018, Roma Tre	L. Masturzo (Bachelor student): b-tagging in ATLAS with ptrel.
2018, Roma Tre	A. Rettaroli (Master student): characterization of superconducting resonant RF cavities for axion search with the QUAX experiment.
2017-2020, Roma Tre	V. Vecchio (Ph.D. student): measurement of the R_b ratio in top quark decays in the de-lepton final state. Uses LHC Run 2 data with the ATLAS detector.
2017-Mar 2018, Roma Tre	A. Marazzi (Bachelor student): efficiency of the Level-1 muon trigger of the ATLAS experiment.
2016, Roma Tre	V. Vecchio (Master student): development of strategies to discriminate signal from prompt lepton backgrounds using kinematical information in the search for the associated production of top quarks and Higgs bosons in the multi-lepton final state. Uses LHC Run 2 data with the ATLAS detector.
2015-start 2017, Roma Tre	M. Sessa (Ph.D. student): search for the associated production of top quarks and Higgs bosons in the multi-lepton final state using LHC Run 2 data with the ATLAS detector.
2011-2014, QMUL	R. Sandbach (Ph.D. student): search for the Standard Model Higgs Boson in $H \to WW(\ell\nu q\bar{q})$ decays in the gluon fusion production mode in the low mass region, using soft muons from the c quark decays. Calibration of Soft Muon Tagger mistag rate. G. Snidero (Ph.D. student): measurement of $t\bar{t}$ cross-section in semi-leptonic channel and of the associated production of a W boson and a charm quark using a Soft Muon Tagger.
2008-11, Nikhef	N. Ruckstuhl (Ph.D. student): measurement of muon momentum scale and resolution using LHC collision and cosmic ray events. A. Doxiadis (Ph.D. student): estimation of the secondary lepton background for the first measurement of $t\bar{t}$ cross-section in (di-)leptonic channels. E.J. Schioppa (CERN Summer Student): timing calibration of the Level-1 Muon trigger with cosmic ray events.
2007, UW	D. Ventura (Ph.D. student): detection of long-lived particles in Hidden Valley models.
2006, Roma 1	M. Nardecchia (Fermilab Summer Student): $b-$flavour tagging using Λ baryons.

Teaching

2020-present	Fisica e didattica della fisica, degree in Primary school education, Roma Tre University
2015-present	Course of particle physics phenomenology for the Master degree in Physics, Roma Tre University
2016-2020	Course on current problems in neutrino physics for the PhD in Physics, Roma Tre University
2015-present	Lab course of sub-nuclear physics for the Bachelor degree in Physics, Roma Tre University
2014-16	Course of sub-nuclear, Roma Tre University
2004	Teaching assistant (Classical mechanics, thermodynamics and electromagnetism), Undergraduate courses, University of Rome, La Sapienza

Outreach

2021	Neutrinos for "Professione ricercatore" with high school students
2014-2019	Notte Europea dei Ricercatori, Roma Tre: "Particles treasure hunt" (2014), seminar on neutrinos (2015), 7 minutes on Dark Matter ("Pillole di scienza", 2016), 7 minutes on anti-matter ("Pillole di scienza", 2018) and "I tarocchi della scienza" (2018, 2019)
Mar 2018	"Occhi su saturno" at Roma Tre, neutrino seminar
Apr 2017	"STEM Careers in science" at Laboratori Nazionali di Frascati
May 2016, Feb 2017-2018-2019	Seminar on neutrinos with Dr. D. Meloni (Roma Tre) for high school students and teachers
2014-15	International Masterclass, Roma Tre.
2013	UK STFC stand on LHC at the Big Bang Fair, London.
2013	International master classes, help in organization at QMUL, London.

Invited talks at international conferences

Sep 2022	"The LEGEND experiment", IPA2022 conference, Vienna, Austria (invited for 2020, cancelled due to COVID)
Aug 2019	"Top quark measurements with the ATLAS detector", 19th Lomonosov conference on elementary particle physics, Moscow, Russia
Jun 2018	"Solar neutrinos with the JUNO experiment", 5th International Solar Neutrino Conference, Dresden, Germany
Aug 2017	"Status and physics potential of JUNO", 18th Lomonosov conference on elementary particle physics, Moscow, Russia
Jan 2016	"Top quark production measurements using the ATLAS detector at the LHC", 6th International Workshop on High Energy Physics in the LHC Era, Valparaiso, Chile
Dec 2014	"Search for the Higgs boson in the ttH production mode using the ATLAS detector", Kruger 2014 conference on discovery physics at the LHC, Kruger National Park, South Africa
Jul 2012	"Measurement of the Top quark mass" , 36th International Conference on High Energy Physics (ICHEP 2012), Melbourne, Australia. Conference Proceedings: http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=174
Sep 2010	"ATLAS Electroweak results" , The XIX International Workshop on High Energy Physics and Quantum Field Theory, Golitsyno, Moscow, Russia. Conference proceedings: http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=104
Oct 2009	"Results from the ATLAS Barrel Level-1 Muon Trigger timing studies using combined trigger and offline tracking" 2009 IEEE Nuclear Science Symposium and Medical Imaging Conference (IEEE NSS MIC 09), Orlando, FL, USA
Jul 2006	"Measurement of B_s oscillations at CDF" 7th International Conference on Hyperons, Charm And Beauty Hadrons (BEACH06), Lancaster, UK. Conference Proceedings published by Nuclear Physics B (proceedings Supplements)
Apr 2006	"Measurement of B_s oscillation frequency at CDF" Incontri di Fisica delle Alte Energie, Pavia, Italy

Additional talks, seminars and posters

Apr 2021	"The LEGEND experiment", invited seminar at the EPAP, King's College London, UK
Nov 2017	"Status and physics potential of the JUNO experiment", invited seminar at the DPNC, Faculté de Physique, Université de Geneve, Switzerland
Mar 2017	"Double Calorimetry System of JUNO experiment" (with Dr. S. Dusini, INFN Padova, Italy), poster at Neutrino Telescopes 2017, Venezia, Italy
Aug 2016	"Solar, supernova, atmospheric and geo neutrino studies using JUNO detector ", poster at ICHEP 2016, Chicago, USA
Aug 2016	"Double Calorimetry System of JUNO experiment" (Main author: Dr. S. Dusini, INFN Padova, Italy), poster at ICHEP 2016, Chicago, USA
May 2015	"Search for the associated production of Higgs bosons and top quarks at $\sqrt{s}$=7-8 TeV with the ATLAS detector at LHC" invited seminar at Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom
Jun 2013	"Top quark physics at LHC: from precision measurements to gateway for new physics" University of Melbourne, Melbourne, Australia
Oct 2011	"Experimental status of Top quark physics at LHC" NExT Institute workshop, Queen Mary University of London, London, United Kingdom
Feb 2010	"Measurement of the Top quark pair production at ATLAS with the first data from LHC" CPPM Laboratory Seminar, Centre de Physique de Particules de Marseille, Marseille, France
Jan 2009	"Early Top physics with ATLAS at the LHC", Physics@FOM Veldhoven 2009
Feb 2006	"B_s and sensitivity to new physics at CDF", Third workshop on b physics, Parma, Italy,
Jul 2005	"Techniques for B_s Mixing at CDF", poster at the Hadron Collider Physics Symposium 2005, Les Diablerets, Switzerland
Apr 2005	"Opposite side B-flavour tagging using combined TOF and dE/dx particle identification technique", American Physics Society April Meeting 2005, Tampa, FL, USA
Feb 2006	"b flavour tagging with Kaons for B physics at CDF", RTN "The third generation as a probe for new physics" meeting, Karlsruhe, Germany

Research Activities

LEGEND (2019-current)

Electronics and bkg veto in liquid argon

Optimization of HV and amplifier card for SiPM read-out in the liquid argon veto. Commissioning of the liquid argon instrumentation for LEGEND-200. Design and implementation of neutron moderators and detectors against cosmogenic backgrounds in view of LEGEND-1000. Design and responsability of project for liquid argon instrumentation electronics for LEGEND-1000.

Reflectivity measurements in VUV

Measurements of reflectivity of germanium detector with the actual surface polishing and shapes in LEGEND-200 and of copper and silicon support elements; down to wavelenghts of ≈125 nm, where LAr photons are emitted. Use of synchrotron radiation and deuterium lamps and design of experimental setup for measurements in vacuum.

Optical response of LAr and tuning of simulation

Design and implementation of cryogenic set-up for measurements of the optical respons of pure ("class 6") LAr for LEGEND-200 and for future noble liquid scintillator R&D.

JUNO (2016-2019)

Detector design optimization

I am working on optimizing the relative positioning of the 3" to the 20" PMTs of JUNO, to maximize the optical photon collection, which has an impact on the stochastical term of the energy resolution. This involves studying the optical interaction of photons with the surfaces of the photocatodes and protective masks of the PMTs.

Physics simulation production and validation

I coordinate the group (10 people internationally) producing the simulated samples and validating their physical content at each stage (from detector response to digitization to PMT waveform reconstruction to energy and position measurement). The samples are used in various detector optimization and JUNO physics potential studies and are currently also envisaged as input to develop the energy calibration procedure.

Solar neutrinos

I am working together with other people from INFN in Italy to develop a strategy to use the JUNO potential to measure the relative abundances of chemical elements in the solar neutrino flux. I am particularly interested in minimizing the intrinsic radioactivity and cosmogenic backgrounds to lower the energy threashold of such measurements, in order to be sensitive to pp and pep channels; and to constrain the impact of new physics on the matter effects in the neutrino oscillations within the sun (< 5 MeV). The current status is documented in my proceedings for the ICHEP16 poster (Salamanna *et al*, arXiv:1610.09508).

Statistical analysis

I am the proponent, with Dr. L. Stanco of INFN Padova, of a new estimator to improve the mass hierarchy determination with reactor neutrino data. (Salamanna *et al*, arXiv:1707.07651v2).

ATLAS (2007-current)

SM Higgs boson searches

- Search for $t\bar{t}H$ decays with 3 leptons in the final state (particularly selection optimization and estimate of background from secondary leptons). Developed a method to estimate the non-prompt and fake lepton background *in-situ*. Worked with T. Baroncelli, M. Sessa and V. Vecchio to discriminate $t\bar{t}H$ from $t\bar{t}V$ using kinematic information (fit full final state) and multi-variate techniques. Work is part of the analysis that reached evidence for $t\bar{t}H$ production mode in Oct 2017.

- 2013: work on top quark background reduction in the $H \to WW(\ell\nu\ell\nu)$+1 jet channel. Crucial issue presently limiting the ATLAS sensitivity in the WW channel. Optimization of b-tagging (incl. soft muon) and developement of kinematic variables: my work is now the main input to a multi-variate technique which will be used for the 2013 publication on $H \to WW$. ATLAS publication in preparation. Internal note: https://cds.cern.ch/record/1624408.

- 2013: With R. Sandbach I have conducted a feasibility study to increase the sensitivity of ATLAS searches to the SM Higgs Boson in the $H \to WW(\ell\nu q\bar{q})$ decay channel in the low mass region. We have studied how to suppress the large backgrounds at low mass using soft muons.

Top quark and W boson physics

Currently I am working with my Ph.D. student, V. Vecchio, to design and perform a measurement of the branching ratio of top quark into bottom quark, looking for sizeable deviations from unity, as predicted in the CKM matrix. This involves a careful definition of the strategy, including b-tagging calibrations. In the past (until 2013) have been involved in several aspects of the ATLAS Top quark physics programme, fundamental part of the experimental probing of the validity of the Standard Model and privileged gateway to New Physics. Where available, links to internal publications are provided to prove my direct engagement. The summary of my contributions includes:

- work on the preparation of the common software, the study and optimization of lepton selections for all ATLAS Top quark measurements (Internal notes: https://cds.cern.ch/record/1226764, https://cds.cern.ch/record/1177146,
https://cds.cern.ch/record/1180281, https://cds.cern.ch/record/1278460,
https://cds.cern.ch/record/1328033, https://cds.cern.ch/record/1312944,
https://cds.cern.ch/record/1447086, https://cds.cern.ch/record/1472525,
https://cds.cern.ch/record/1509562);

- primary author of two measurements of the $t\bar{t}$ production cross-section in the lepton + jets channel, with the full 2010 and 2011 datasets, using likelihood fitting techniques based on Monte-Carlo templates. ATLAS publication: Phys. Lett. B 711, 244 (2012), Eur. Phys. J. C 71, 1577 (2011).
ATLAS conference note: https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2011-035/;

- primary author of the measurement of the $t\bar{t}$ production cross-section in the lepton + jets channel with the full 2011 dataset (2012, 5 fb^{-1}), using a sample of semileptonic b-decays (window on new physics in sample orthogonal to standard ATLAS analysis). ATLAS conference note: https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2012-131/

- contribution to measurement of $W + c$ production from the correlation of the charges of the W lepton and a soft muon from c quark decays: such measurement probes the s quark content in protons and studies one of the most relevant backgrounds for Top quark and BSM physics. ATLAS publication in preparation;

Soft Muon Tagger

2011-2012: calibration of the Soft Muon b-Tagging algorithm, using an inclusive QCD multi-jet sample. The tagger is applied to several measurements of Standard Model processes and in Higgs boson searches to suppress top quark decays. The algorithm and its performance are documented in a refereed paper on the performance of b-jet identification in ATLAS, 2016 JINST 11 P04008.

Study of detection of long-lived particles expected in New Physics scenarios

Particles travelling a long path length (up to some meters) before decaying are expected in many different New Physics scenarios and need dedicated trigger signatures. During my time at the Univ. of Washington I have developed and proposed specific trigger paths, using calorimetry and muon information, to detect long lived particles from Hidden Valley models.

Study and measurement of Muon momentum resolution

- I have been the coordinator and a primary author of the measurement of the muon momentum scale and resolution as a function of muon kinematics and track quality. The techniques and tools are currently in use for all ATLAS analysis with muons in the final state. ATLAS publication: Eur. Phys. J. C 70, 875 (2010).
  ATLAS conference note: https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2011-046/.
- first ATLAS measurement of momentum scale and resolution, using the momentum imbalance between the MS and ID measurements on single muons. Measurement presented at the ICHEP 2010 conference

Level-1 Muon trigger time alignment

2015-17: I am working again on the calibration and performance of the Level-1 Muon trigger in the barrel, using the methods described below and correlating hardware defects with trigger inefficiencies for fast diagnostics. 2010-11: I have developed and performed a technique to synchronize the Level-1 Muon trigger elements by comparing their time response to an external time reference, with reconstructed offline muon tracks. Work vital for all analysis using muons, to maximize the event efficiency and perform an unbiased event building. The procedure has been used by ATLAS to achieve full synchronization during the trigger commissioning with collision and cosmic ray events. ATLAS publication: Eur. Phys. J. C 72, 1849 (2012).

CDF (2002-2006)

First observation of B_s oscillations and measurement of their frequency ΔM_s

The observation of the oscillations of B_s mesons and their frequency measurement is one of the major highlights of the Tevatron physics program, given its constraint on New Physics in the flavour sector. CDF has performed this measurement in 2006 and I am one of the authors. The two publications for the evidence and then observation of the phenomenon are, respectively: Phys.Rev.Lett. 97 (2006) 062003), Phys.Rev.Lett. 97 (2006) 242003
I have directly been responsible of the following parts:

- the development, for the first time at a hadron collider, of an Opposite Side Kaon tagger, increasing the statistical sensitivity to oscillations (CDF Internal note CDF8179);
- the combination of flavour taggers into Neural Network, providing the necessary sensitivity for B_s^0 mixing measurement (CDF Internal Note CDF8314);
- the completion of an independent measurement of ΔM_s using a Fourier Tranform approach, alternative to the Amplitude method, used as a cross-check of the *mainstream* result.

My work on flavour tagging has also contributed to other time-dependent measurements, notably Phys. Rev. Lett. 100, 161802 (2008)

Study of time resolution of the Time-of-Flight detector

The TOF detector is a crucial tool for particle identification in CDF, and in particular it is used in all time-dependent b physics measurements for flavour tagging. Its time resolution is the most important parameter in terms of Particle Id. I have been in charge of studying the contributions to the resolution from tracking and electronics. CDF Internal notes: CDF6810, CDF7488, CDF8169.