Prof. Maria Agnese Ciocci

Scientific and Academic Curriculum Vitae

Personal Data

- **Date and Place of Birth:** August 13, 1959, Marino (RM), Italy
- **Nationality:** Italian
- **Work Affiliations:**
  - University of Siena, Department of Physical Sciences, Earth and Environment, Physics Building, Via Roma 56, 53100 Siena, Italy. Tel: +39 0577 233372
  - National Institute for Nuclear Physics (INFN) Pisa Section, Building C, Largo Bruno Pontecorvo 3, 56127 Pisa, Italy. Tel: +39 050 221 4245
- **Email:** ciocci@pi.infn.it
- **ORCID:** orcid.org/0000-0003-0002-5462

Academic and Professional Positions

- **1986:** Master's Degree in Physics, Sapienza University of Rome, Grade 110/110.
- **1986–1987:** Advanced Postgraduate Studies in Physics, University of Pavia.
- **1988–1989:** Researcher at the National Institute of Nuclear and Particle Physics (IN2P3), Ecole Polytechnique, Palaiseau (France).
- **1990–1992:** Research Fellowship, National Institute for Nuclear Physics (INFN), Pisa Section.
- **1992–1993:** Fixed-Term Researcher (ex Art. 36), INFN Pisa Section.
- **1994–1997:** Specialization School in Medical Physics, University of Pisa.
- **1997:** Specialization Diploma in Medical Physics, Grade 50/50 cum laude.
- **1998:** Fixed-Term Contract, University of Pisa.
- **1999–2001:** Professional Contracts, University of Siena.
- **2001 – Sept 30, 2016:** Assistant Professor (Ricercatore Universitario), University of Siena, Department of Physical Sciences, Earth and Environment, Sector: FIS/01 - Experimental Physics.
- **Oct 1, 2016 – Nov 30, 2017:** Assistant Professor (Ricercatore Universitario), University of Pisa, Department of Physics, Sector: FIS/01 - Experimental Physics.
- **Classification since 2011:** Academic Recruitment Field 02/A1 - Experimental Physics of Fundamental Interactions.
- **Dec 1, 2017 – Feb 28, 2025:** Associate Professor, University of Pisa, Department of Physics, Sector: FIS/01 - Experimental Physics.
- **March 1, 2025 – Present:** Associate Professor, University of Siena, Department of Physical Sciences, Earth and Environment, Sector: FIS/01 - Experimental Physics.
- **National Scientific Qualification (ASN 2012 Call):** Achieved qualification for Full and Associate Professor positions in sector 02/A1.

Research Activities

I have carried out my scientific research activities in:

- **High Energy Physics Experiments:** CERN-NA1, CERN-ALEPH, FNAL-CDF, CERN-CMS.
- **Astroparticle Physics Experiments:** IAC-CLUE.
- **Medical Physics:** Digital Mammography.

Detailed Description of Research Activities

1985–1987: CERN-NA1

For the NA1 experiment at CERN, I worked on the utilization of silicon and germanium detectors (the first solid-state detectors used in high-energy physics) to select and measure the lifetime of charmed mesons and baryons produced via coherent photoproduction. The primary objective was studying the properties of D charmed mesons. I participated in measuring the D^0 lifetime [1] and subsequently proposed searching for the charmed baryon Λ_c^+ (only a few decays of which had been observed at the time) and measuring its lifetime using Cherenkov identification for protons and a germanium-silicon target for decay length reconstruction. My Master's thesis details the observation of new decay channels of Λ_c^+: $\Lambda_c^+ \to \Delta^{++}K^{*-} \to pK^-\pi^+\pi^0$ and $\Lambda_c^+ \to \Delta^+K^{*0} \to pK^-\pi^+\pi^0$ and the measurement of its lifetime. Thesis results were published in [2].

1987–1998: CERN-ALEPH

I authored (1987) and led the reconstruction and identification software program for secondary vertices (K^0 and photon conversions with detector material) [3]. My expertise enabled my participation in key ALEPH measurements, including:

- Track and secondary vertex reconstruction performance of the Time Projection Chamber (TPC) and the ALEPH Silicon Strip Vertex Detector (installed in 1990) featuring double-sided microstrip sensors [4].
- Primary vertex reconstruction in e^+e^- collisions.
- Selection and property measurements of the τ lepton and heavy-quark (b, c) particles.
- Lifetime measurements (τ lepton and heavy-quark particles) [5].
- Material distribution mapping inside the apparatus using photon conversions.
- K^0 production in hadronic Z decays and τ decays [6].
- In the $e^+e^- \to Z \to \tau^+\tau^-$ analysis group, I contributed to measuring Z decay width and branching ratio into $\tau^+\tau^-$ [7], developing innovative methods for τ lifetime measurement [8] that significantly enhanced experimental precision compared to traditional approaches.

1995–2001: Digital Mammography

I conducted my Medical Physics Specialization thesis in collaboration with the MEDIM (INFN-CERN) group in Pisa, aiming to build a digital mammography imaging system using Gallium Arsenide (GaAs) pixel detectors. I led the simulation and calculation of the electric field in GaAs detectors of varying thicknesses for medical applications. At the time, no simulation packages existed for such detectors. My simulation perfectly reproduced the reduced charge collection efficiency observed experimentally. Results were detailed in my thesis *"Simulation of GaAs detectors for digital radiography applications"* and published in two papers [9].
Under PRIN 1998 (*"Advanced imaging techniques for medical, environmental, and cultural heritage applications"*), I designed, optimized, and built an experimental apparatus for Compton scattering reduction in mammography [10].

2000–2001: IAC-CLUE

I developed an innovative high-precision technique derived from high-energy physics for reconstructing the arrival direction and impact point of primary cosmic rays on CLUE telescopes (INFN experiment in the Canary Islands), boosting source identification efficiency [11].

2002–2012: FNAL-CDF

I evaluated the performance of the Silicon Vertex Trigger (SVT) and its upgrade (GigaFitter) [12] in selecting beauty hadrons, contributing actively to the experiment's B Physics and High p_T Physics groups.
Key contributions as a primary author include:

- Reconstruction and selection of high-purity K^0 samples to study $K-\pi$, $p-\pi$, and $p-K$ particle identification via the Time-of-Flight (TOF) detector and the Central Outer Tracker (dE/dx) [13].
- Development and tuning of a sophisticated particle identification algorithm combining dE/dx and TOF [14].
- Search and analysis of two-body charmless decays of B_s, B_d mesons, and Λ_b^0 baryons selected with SVT [15].
- Measurement of kinematic properties and species fractions of charged particles produced in association with b-hadrons (B^+, B^0, B_s, Λ_b^0) [16].
- Study of $B^- \to D^0 K^-$ decays for measuring the CKM matrix angle γ [17].
- Observation and cross-section measurement of associated $WW+WZ \to$ lepton + neutrino + jets production and dijet invariant mass spectrum analysis [18].
- Inclusive decay studies of the Λ_b^0 baryon, leading to the observation of decay components: $\Lambda_b^0 \to \Lambda_c^+[pK^-\pi^+]\pi^-$, $\Lambda_b^0 \to \Lambda_c^{*+}(2595)\pi^-$, $\Lambda_b^0 \to \Lambda_c^{*+}(2625)\pi^-$, $\Lambda_b^0 \to \Sigma_c^0\pi^+\pi^-$, and $\Lambda_b^0 \to \Sigma_c^{++}\pi^-\pi^-$, as well as relative branching ratio measurements [19, 20].

Roles and Supervised Theses in CDF:

- Author of 34 internal notes.
- Advisor/Co-advisor for numerous Master's and Ph.D. theses at the University of Siena:
  - **Stefano Torre**, Ph.D. Thesis (2005), *"Search for Λ_b^0 decays in $p\pi$ and pK at CDF II"* [21, 22, 23].
  - **Paola Squillacioti**, Ph.D. Thesis (2006), *"Measurement of the Branching fraction ratio..."* [24]. Implemented PID algorithms; achieved the first hadron collider measurement of CP asymmetries in $B \to DK$ [25, 26, 27].
  - **Pierluigi Catastini**, Ph.D. Thesis (2006), *"Measurement of kinematic properties..."* [28]. Contributed to the B_s mixing discovery analysis [29, 30].
  - **Guido Volpi**, Ph.D. Thesis (2008), *"Rare decays of B mesons and baryons..."* [31]. First observation of $\Lambda_b^0 \to p\pi^-$ and $\Lambda_b^0 \to pK^-$ [32, 33].
  - **Januscia Duchini**, M.Sc. Thesis (2010), *"A multivariate approach for the extraction of WW/WZ $l\nu$ + jets events"* [34].
  - **Viviana Cavaliere**, Ph.D. Thesis (2010), *"Measurement of WW + WZ production cross section..."* [36] (Winner of the 2012 INFN "Marcello Conversi" Prize) [35, 37].
  - **Patrizia Barria**, Ph.D. Thesis (2011), *"First Observation of Charmed Resonances in Λ_b^0 Inclusive Decays..."* [38, 39, 40].
- Principal Investigator for several research grants and post-doc funding (PRIN 2003, PRIN 2005, PRIN 2008).

July 2012 – Present: CERN-CMS

- **(a) Detector Data Taking (Run 1 & Run 2, 2012–2018):** Tracker-Offline-Shift-Leader and manager responsible for the online data quality certification of the silicon tracker.
- **(b) Phase-1 Silicon Pixel Upgrade (2014–2016):** Testing of pixel sensors installed in Feb 2016 [41].
- **(c) Phase-2 Track Trigger (2012–2015):** Trigger optimization for real-time track reconstruction down to 2 GeV/c for HL-LHC [42].
- **(d) Advanced Pixel Sensor Simulations (2017–2019):** Italy-India scientific cooperation project developing radiation-tolerant silicon sensors for HL-LHC [43].
- **(e) Double Higgs Boson Production Search ($bb\tau^+\tau^-$ channel):** Local Coordinator for the Pisa team. Focus on HH decay into $b\bar{b}\tau^+\tau^-$ (semileptonic and fully hadronic channels). Analyses on Run 1 [44] and Run 2 [45, 46] data. Constraints on anomalous Higgs couplings (K_λ, K_t, K_{2V}) [47] and HL-LHC sensitivity projections [48, 49, 50].
  Supervised Ph.D. Theses in CMS:
  - Konstantin Androsov (Univ. Siena, 2015) – http://www.infn.it/thesis/thesis_dettaglio.

php?tid=10263
  - Maria Teresa Grippo (Univ. Siena, 2016) – http://www.infn.it/thesis/thesis_dettaglio.php?tid=11191
  - Maria Rosaria Di Domenico (Univ. Siena, 2021) – https://usiena-air.unisi.it//handle/11365/1144841
  - Valeria D'Amante (Univ. Siena, 2025) – https://usiena-air.unisi.it/handle/11365/1292154
  - Sayan Dhani (Univ. Siena, in progress, defense scheduled Oct 2027).

  Pisa Team Key Innovations: Advanced multivariate techniques for $t\bar{t}$ background [47], deep learning algorithms for tau identification (DeepTau, adopted CMS-wide) [51], and Deep Neural Networks for b-jet tagging [52].
- **(f) Phase-2 Upgrade (HL-LHC) – PRIN 2022 "HHTime" (2023–2025):** Utilizing ultra-precise time information (30–40 ps) from the MIP Timing Detector (MTD) for 4D event reconstruction and pile-up mitigation.
- **Funding Received:** PRIN 2012, FP7-PEOPLE-2012-ITN INFIERI, MAE Italy-India, PRIN 2022.

Academic Titles, Honors, and Awards

- **M.Sc. in Physics**, Sapienza University of Rome, 110/110 (1986).
- **Postgraduate Diploma in Physics**, University of Pavia (1986–1987).
- **IN2P3 Researcher**, Ecole Polytechnique, Palaiseau, France (1988–1989).
- **INFN Research Fellowship** (Ranked 1st nationwide in High Energy Physics) (1990–1992).
- **Specialization Diploma in Medical Physics**, University of Pisa, 50/50 cum laude (1997).
- **Assistant Professor**, University of Siena (2001–2016) and University of Pisa (2016–2017).
- **Associate Professor**, University of Pisa (2017–2025) and University of Siena (2025–Present).
- **National Scientific Qualification (ASN):** Qualified as Full Professor (Sector 02/A1).
- **INFN Research Associate:** Associated since 1985; Official Research Assignment since 2001.
- **Associated Member of Personnel (User)**, CERN.
- **Co-recipient, 2025 Breakthrough Prize in Fundamental Physics (March 2025):** Awarded as a member of the CMS Collaboration (CERN) for high-precision scientific contributions regarding the Higgs Boson and high-energy physics.

Scientific Participation in Research Projects

National (PRIN) and Local Projects

- **PRIN 1998:** Advanced imaging techniques for medical, environmental, and cultural applications.
- **PRIN 2002:** University laboratory network for advanced instrumentation development.
- **PRIN 2003:** Automatic pattern recognition for experimental physics.
- **PRIN 2005:** Gigafitter: ultra-fast processor for complex event reconstruction.
- **PRIN 2008:** Novel trigger strategies for hadron colliders (Deputy Research Unit Leader).
- **PRIN 2012:** H-TEAM: Trigger, Advanced Electronics, and Innovative Methods for the LHC Higgs Search (Siena Research Unit Leader).
- **PRIN 2022:** HHTime: HH searches at the HL-LHC exploiting Time information (Pisa Research Unit Leader).
- **University of Pisa Research Grants:**
  - 2017–2018: Higgs boson physics at future colliders.
  - 2020–2021: Heterogeneous computing with FPGAs.

International Projects

- **FP7-PEOPLE-2012-ITN INFIERI** (2013–2017): Executive Committee Member, Work Package 8 Leader (Dissemination & Outreach) (https://cordis.europa.eu/project/id/317446).
- **MAE Executive Program Italy-India (2017–2019):** Simulation studies and tests to develop radiation tolerant silicon detectors for high-luminosity colliders (http://www.esteri.it/mae/resource/doc/2017/04/protocollo_esecutivo.pdf).

Teaching Activities

- **2001 – 2016 (Univ. of Siena):** Lecturer for Applied Physics, Optics, Modern Physics, Physical Methods for Medical Diagnostics, and Nuclear/Subnuclear Physics across B.Sc., M.Sc., and specialization programs.
- **2016 – 2025 (Univ. of Pisa):** Lecturer for Medical Area courses and General Physics I for Computer, Biomedical, and Telecommunications Engineering.
- **2025 – Present (Univ. of Siena):** Lecturer for Physics for Medicine, Physics I, and Medical Physics for Advanced Technologies; Applied Physics for Dentistry and Dental Prosthodontics, and Applied Physics for Medical Radiology Techniques.

Affiliations and Institutional Governance

- **INFN:** Research Associate since 1985; Official Research Assignment (2001–Present). Local Coordinator for the Siena group affiliated with INFN Pisa Section (2012–2016 and 2025–Present).
- **CERN / FERMILAB:** CERN User (1986–1998; 2012–Present); Fermilab User (2002–2012).
- **Institutional Committees:** Faculty member of the Ph.D. Board at Univ. of Siena (2003–Present); Academic Teaching Committee Member (2004–2010); University VQR Evaluation Committee (2012); President of the Research Quality Assurance Committee at DSFTA Univ. of Siena (2015–2016).

Conferences, Refereeing, and Outreach

- **Conference Organization:** Pisa Meeting on Advanced Detectors (Local Committee since 2006); ICFDT 2016 (https://agenda.infn.it/conferenceDisplay.py?confId=9738); HCP 2007; INFIERI 2015/2025 (https://www.pi.infn.it/infieri2025/); CMSDAS 2019 (https://indico.cern.ch/event/758324/registrations/45152/); Higgs Pairs 2025 (Co-Chair, https://indico.cern.ch/event/1399335/); FAST Workshop 2023/2025 (https://indico.cern.ch/event/1214183/); Higgs 2022 (https://indico.cern.ch/event/1086716/).
- **Refereeing & Editing:** Reviewer for MIUR/REPRISE (FIRB, Montalcini Program); Polish National Science Center (OPUS-23); Reviewer for *NIMA* and *Physics Letters B*; Guest Editor for *EPJ Plus* (https://link.springer.com/article/10.1140/epjp/s13360-022-02552-7).
- **Publications & Citation Metrics:** Over 1800 publications in international peer-reviewed journals (SPIRES author: http://inspirehep.net/search?p=exactauthor%3AM.A.Ciocci.1). **h-index: 119** (Web of Science).
- **Public Outreach:** Speaker at the 16th International Masterclass (https://agenda.infn.it/event/25713/); Steering member since 2019 for *Art & Science Across Italy* (https://artandscience.infn.it/).

References

Note: The suffix "pub" refers to the publication entry in the complete CV attachment; "N" refers to internal collaboration notes.

[1] pub1

[2] pub2

[3] N1

[4] pub16, pub25, pub55, pub61, N2

[5] pub46, pub62, pub81, pub54, pub28

[6] pub87, pub88

[7] pub5, pub23, pub14, pub7, pub36, pub68

[8] pub46, pub62, N3, N4

[9] pub104, pub111

[10] pub195, pub196

[11] pub191, pub192

[12] pub255, pub256, N9

[13] N13, N12

[14] N20, N24

[15] N6, N7, N8, N10, N16, N17, N18, N19, N21, N26, N29, pub149, pub231

[16] N23, N25

[17] N22, N27, N30, pub415

[18] N36, N32, pub420, pub479

[19] N28, N33, N34, N35, N37, N38, pub520

[20] N28

[21] http://inspirehep.net/record/923664?ln=en

[22] pub231

[23] N16, N17

[24] FERMILAB-THESIS-2006-27, http://inspirehep.net/record/733739?ln=en

[25] pub415

[26] N22, N27, N30

[27] http://www-cdf.fnal.gov/physics/new/bottom/071018.blessed-BDK_rev080724/

[28] FERMILAB-THESIS-2006-84, http://inspirehep.net/record/741418/

[29] pub277, pub270

[30] N23, N25

[31] FERMILAB-THESIS-2008-56, http://inspirehep.net/record/804636?ln=en

[32] pub375

[33] N29

[34] http://www.infn.it/thesis/thesis_dettaglio.php?tid=4513

[35] pub420

[36] FERMILAB-THESIS-2010-51, http://inspirehep.net/record/881126?ln=en

[37] pub479

[38] http://www.infn.it/thesis/thesis_dettaglio.php?tid=5928

[39] http://www-cdf.fnal.gov/physics/new/bottom/110721.blessed-Lb2Lc3pi_BF/LbLc3pi.html

[40] pub520

[41] pub1290

[42] N40

[43] pub1007

[44] N39, pub713

[45] N41, pub899, N42, N43, pub1420

[46] N41, pub899

[47] N41, pub899, N42, pub1420

[48] L. Cadamuro on behalf of CMS and ATLAS collaborations, Search and prospects for HH production, "52nd Rencontres de Moriond on Electroweak Interactions and Unified Theories", La Thuile, Italy, March 25th - April 1st, 2017, https://cds.cern.ch/record/2286053

[49] pub1074, pub1424

[50] pub776

[51] pub1381

[52] N43