Antonio Gilardi, PhD

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Education

Main Education

PhD in Information Technology 2018 – 2021
Università Degli Studi di Napoli "Federico II" · Naples (IT)
- Thesis: *"Measurements of wakefields and bunch length with beam in a linear electron accelerator: a case study at the CLEAR facility"*
- Evaluation: Summa cum laude
- Key topics: Beam dynamics theory and simulation, Accelerator operations and Accelerator Optimization.

M.Sc. in Electronic Engineering 2015 – 2017
Università Degli Studi di Napoli "Federico II" · Naples (IT)
- Thesis: *"Innovative way to damp resonances in CERN accelerators, using HOM couplers"*
- Evaluation: Summa cum laude
- Key topics: Electromagnetic theory and technology, Beam dynamics and FEM simulation.

B.Sc. in Electronic Engineering 2012 – 2015
Università Degli Studi di Napoli "Federico II" · Naples (IT)
- Thesis: *"True time delay in optical fiber for Phased Array Antennas (PAAs) with the use of Bragg gratings and piezoelectric devices"*
- Evaluation: Summa cum laude
- Key topics: Circuit simulation, RF system design and Optoelectronics.

Industrial Technical High School Degree 2007 – 2012
ITIS "Alessandro Volta" · Naples (IT)
- Evaluation: Summa cum laude
- Key topics: Information technology, Electronics theory and applications, and Electrical theory and applications.

Selected Training & Schools

Thematic CERN School of Computing (tCSC) on Machine Learning 2024
CERN · Split (HR)
- Machine Learning and Artificial Intelligence applied to Data Analysis and Accelerator Technology.

US Particle Accelerator School (USPAS) 2022
Texas A&M University · Berkeley (US)
- Optimization and Machine Learning for Accelerators.

Joint Universities Accelerator School (JUAS) 2018
European Scientific Institute (ESI) · Archamps (FR)
- The technology and applications of particle accelerators.

Joint Universities Accelerator School (JUAS) 2018
European Scientific Institute (ESI) · Archamps (FR)
- The science of particle accelerators.

Experience

Senior Fellow, Conseil Européen pour la Recherche Nucléaire (CERN)
Geneva (CH) March 2024 – Present
- CLEAR team member responsible for experiment delivery and end-to-end beamline readiness (planning, setup, commissioning support, and shift operations).
- Own and evolve key diagnostics on the CLEAR beamline: calibration, data-quality monitoring, troubleshooting, and performance optimization to ensure reliable measurements for users.
- Lead an R&D line on machine-learning-enabled accelerator optimization, developing predictive/feedback models to improve beam stability and operational efficiency.
- Strongly involved in student supervision and outreach/teaching activities.

Faculty Staff - Level II, SLAC National Accelerator Laboratory
Menlo Park (US) July 2022 - November 2023

- Operations team member for the Macromolecular Femtosecond Crystallography (MFX) hutch and the MeV-UED accelerator, supporting user experiments from preparation through execution.
- Served as Point of Contact (POC) for both facilities, coordinating readiness reviews, run plans, and on-shift troubleshooting to maximize beamtime efficiency.
- Consolidated and modernized the controls infrastructure (configuration, interfaces, and operational tools), improving maintainability and day-to-day operator workflows.
- Contributed to the controls design phase of the LCLS-HE upgrade by defining requirements and providing operations-driven integration input.

PostDoctoral Research Fellow, Lawrence Berkeley National Laboratories (LBNL)
Berkeley (US) July 2021 - July 2022

- Developed software and hardware solutions for coherent laser beam combining, targeting stability and performance for advanced-acceleration concepts in particle-physics applications.
- Designed a deep-learning-based feedback approach to stabilize the combined beam by controlling mirror actuation, improving robustness to drift and perturbations.
- Built an experimental workflow spanning data acquisition, model training/validation, and closed-loop control prototyping.

Doctoral Studentship, Conseil Européen pour la Recherche Nucléaire (CERN)
Geneva (CH) March 2018 - May 2021

- Awarded an international doctoral grant within BE deparment LAF section, in collaboration with Università degli Studi di Napoli "Federico II"; full-time research conducted at CERN.
- Core contributor to CLEAR LINAC operations and experimental program, supporting users with hardware setup, feasibility simulations, and post-processing/analysis (including medical-oriented studies).
- Led beam-physics studies on transverse fields impacting bunch dynamics: (i) parasitic transverse wakefields in high-gradient X-band structures, and (ii) transverse deflecting fields for bunch-length measurements with an RF Deflector (RFD).
- Delivered theory-driven results validated through simulations and beam measurements; gained hands-on experience both in accelerator and laser.

Technical Studentship, Conseil Européen pour la Recherche Nucléaire (CERN)
Geneva (CH) February 2017 - March 2018

- Awarded an international technical student grant in BE deparment HSC ssection; investigated beam impedance and wakefields from analytical models to numerical studies on real accelerator components.
- Performed electromagnetic simulations for devices including the crystal collimator and beam gas ionization monitor, translating results into actionable impedance/wakefield insights.
- Developed a frequency-domain resonance identification method based on a three-parameter sine fit, improving extraction of mode frequencies from measurement/simulation spectra.

Teaching assistant, Università Degli Studi di Napoli "Federico II"
Napoli (IT) January 2012 - February 2017

- Provided recurring academic support to high-school and university students (typically about 8 students/year; around 8 hours/week).
- Taught and reviewed mathematics and physics fundamentals (geometry, calculus, mechanics, electromagnetism) and engineering basics (RF, circuits, digital logic), including introductory computer science and databases.

EXPERTISE
DAILY USAGE - PAST USE

- *Coding:* **Python, MATLAB**, GEANT4, Wolfram Mathematica, C, C++, LabVIEW, Arduino.
- *Frameworks:* **PyTorch, scikit-learn, JAPC, EPICS**, Keras 3.0.
- *Hardware*: **Oscilloscope, Multimeter, 3D printer, LASER cutter**, VNA, CNC, Spectrum Analyzer, Signal Generator.
- *Simulation:* ***RF-Track****, MadX, CST, PSpice, ANSYS, VHDL, Verilog*.
- *Others:* ***Fusion360, LaTeX****, Photoshop*.

SOFT SKILLS

- Cross-functional collaboration, Scientific communication, Student supervision, Ownership and accountability, Problem solving, Root-cause analysis, Adaptability, Conflict management.

Invited Seminars & Talks

- ***Talk**: "Twin-Beam, ML-Orchestrated FLASH Room"* December 2025
  FLASH Radiotherapy and Particle Therapy (FRPT) Conference - Prague (CZ)
- ***Seminar**: "Medical Activities in CLEAR: Studies Towards Radiotherapy Using Very High Energy Electrons (VHEE) in the FLASH Regime"* October 2024
  EURO-LABS 3rd Annual Meeting - CERN (CH)
- ***Seminar**: "Operational improvements and upgrades of the CLEAR user facility"* October 2024
  EURO-LABS 3rd Annual Meeting - CERN (CH)
- ***Seminar**: "Bunch length measurements with RFD in linear electron accelerators: a case study at CLEAR"* June 2022
  University of California Los Angeles (UCLA - Los Angeles (US)
  Hosted by Prof. Pietro Musumeci.
- ***Seminar**: "Main measurement on particle accelerator"* November 2019
  Università Degli Studi di Napoli "Federico II" - Napoli (IT)
  Hosted by Prof. Leopoldo Angrisani.
- ***Talk**: "Introduction to CERN"* October 2019
  ITIS "Alessandro Volta" - Napoli (IT)
- ***Seminar**: "Wakefield measurement at CLEAR"* September 2019
  Brookhaven National Laboratory (BNL) - New York (US)
  Hosted by Prof. Joshi Piyush.
- ***Seminar**: "Measurement on particle accelerator beam: the CERN CLEAR facility"* May 2019
  Macquarie University - Sydney (AU)
  Hosted by Prof. Subhas Mukhopadhyay.

Editorial Activity

- **Local Organizing Committee:** *5th ICFA Beam Dynamics Mini-Workshop on Machine Learning for Particle Accelerators* 2025
  Geneva (CH)
- **Guest Editor:** *Frontiers in Physics* (Accelerator Physics section) 2023 - Present
- **Organizing Committee:** *SLAC MeV-UED Instrument Retreat* 2023
  Menlo Park (US)
- **Session Chair:** *Efficiency and Explainability in Machine Learning and Soft Computing* 2022
  Salamanca (ES)
- **Conference Committee:** *3rd Advanced Materials Science World Congress* 2022
  London (UK)
- **Organizing Committee:** *Metrology for Extended Reality, Artificial Intelligence and Neural Engineering* 2020
  Rome (IT)
- **Reviewer for peer-reviewed journals:** including *Physical Review Accelerators and Beams*, *Nuclear Instruments and Methods in Physics Research Section A*, *Scientific Reports*, *IEEE Transactions on Instrumentation and Measurement*, and *Journal of Instrumentation* 2021 - Present

Awards & Founding

- ***Awards:** "Extraordinary Service Award"* 2025
  Conseil Européen pour la Recherche Nucléaire (CERN) - *Geneva (CH)*
- ***Awards:** "Spotlight Award"* 2023
  SLAC National Accelerator Laboratory - *Menlo Park (US)*
- ***Grant:** USPAS - Optimization and Machine Learning for Accelerators* 2022
  Texas A&M University, United States - *Berkeley (US)*
- ***Awards:** Highest honor student PhD* 2021
  Università Degli Studi di Napoli "Federico II" - *Napoli (IT)*

- ***Awards:*** *"Massimo D'Apuzzo - Extraordinary Project "* 2020
  Group of Electric and Electronic Measurement (GMEE) - *Milano (IT)*
- ***Grant:*** *Student grant IPAC20* 2020
  Caen (FR)
- ***Grant:*** *Student grant I2MTC19* 2019
  Auckland (NZ)
- ***Grant:*** *JUAS - The technology and applications of particle accelerators* 2018
  European Scientific Institute (ESI) - *Archamps (FR)*
- ***Grant:*** *JUAS - The science of particle accelerators* 2018
  European Scientific Institute (ESI) - *Archamps (FR)*
- ***Grant:*** *"Impedance and beam instabilities in particle accelerators"* 2017
  International Committee for Future Accelerators (ICFA) - *Benevento (IT)*
- ***Awards:*** *Highest honor student MSc* 2020
  Università Degli Studi di Napoli "Federico II" - *Napoli (IT)*
- ***Awards:*** *Highest honor student BSc* 2015
  Università Degli Studi di Napoli "Federico II" - *Napoli (IT)*
- ***Grant:*** *Fully financed scholarship* 2015
  Scuola Normale Superiore (SNS) - *Pisa (IT)*
- ***Awards:*** *"The most interesting green project"* 2013
  EnergyMed - *Naples (IT)*

Teaching Activities

Student Supervision

- **CERN – Geneva (CH)** 2024 – Present
  - **Direct supervision (Technical Students):**
    - C. Moore — Second beamline characterization and deployment.
    - S. Simonsson — Beam-orbit studies and enhancement of beam diagnostics.
    - O. Franek — Charge forecasting using machine-learning methodologies.
  - **Co-supervision:**
    - PhD: J. Leygonie — Digital twin for medical LINAC
    - PhD: S. Wang — Beamdynamics studies for uniform beam production and delivery.
    - PhD: G. Tangari — Tomography methods for improved phase-space reconstruction.
    - Technical Student: A. Petersson — Quadrupole-scan approach for beam-energy studies.
- **SLAC National Accelerator Laboratory – Menlo Park (US)** 2023
  - **Supervision:**
    - M. Estrada — Controls integration of Newport motors into the MeV-UED system.

Lectures

- Hands-on Lattice Calculations 2025
  CERN Accelerator School (CAS) – *Santa Susanna (ES)*
- Metrology and Machine Learning for Brain–Computer Interfaces 2023
  Università degli Studi di Napoli "Federico II" – *Napoli (IT)*
- "How to Operate a Real Accelerator at CERN" 2020
  European Scientific Institute (ESI) – *Archamps (FR)*
- "The CLEAR Accelerator at CERN" 2019
  European Scientific Institute (ESI) – *Archamps (FR)*

Language

Italian: **Mother tongue** *Neapolitan:* **Mother tongue** *English:* **Proficient**
French: **Intermediate** *Spanish:* **Elementary**

Selected Peer-Reviewed Publications

Journal

[1] Fischer J, **Gilardi A**, Korysko P, Malyzhenkov A, Hart A, Farabolini W, Rieker V, Ruderic T, Bateman J, Corsini R, Dosanjh M. Impact of Beam Collimation on Very High Energy Electron Radiotherapy Plans. MEDICAL PHYSICS 2025 Aug 1 (Vol. 52, No. 8, pp. 38-39). 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY.

[2] King M, Benitez S, Christie A, Effinger E, Esteban J, Farabolini W, **Gilardi A**, Korysko P, Meyer JM, Salvachua B, Welsch CP. A systematic investigation of beam losses and position-reconstruction techniques measured with a novel oBLM at CLEAR. Instruments. 2025 Feb 28;9(1):4.

[3] Rieker VF, Corsini R, Stapnes S, Adli E, Farabolini W, Grilj V, Sjobak KN, Wroe LM, Aksoy A, Robertson CS, Bateman JJ, Korysko P, Malyzhenkov A, **Gilardi A**, Dosanjh M. Active dosimetry for VHEE FLASH radiotherapy using beam profile monitors and charge measurements. Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment. 2024 Dec 1;1069:169845.

[4] Cropp F, Moos L, Scheinker A, **Gilardi A**, Wang D, Paiagua S, Serrano C, Musumeci P, Filippetto D. Virtual-diagnostic-based time stamping for ultrafast electron diffraction. Physical Review Accelerators and Beams. 2023 May 1;26(5):052801.

[5] Lauria A, Arpaia P, Buzio M, **Gilardi A**, Parvis M, Pentella M, Sabbatini L, Simoni E, Vannozzi A. Rotating-coil measurement system for small-bore-diameter magnet characterization. Sensors. 2022 Oct 31;22(21):8359.

[6] Wang D, Du Q, Zhou T, **Gilardi A**, Kiran M, Mohammed B, Li D, Wilcox R. Machine learning pattern recognition algorithm with applications to coherent laser combination. IEEE Journal of Quantum Electronics. 2022 Sep 5;58(6):1-9.

[7] Du Q, Wang D, Zhou T, **Gilardi A**, Kiran M, Mohammed B, Li D, Wilcox R. Experimental beam combining stabilization using machine learning trained while phases drift. Optics Express. 2022 Mar 31;30(8):12639-53.

[8] Kokurewicz K, Brunetti E, Curcio A, Gamba D, Garolfi L, **Gilardi A**, Senes E, Sjobak KN, Farabolini W, Corsini R, Jaroszynski DA. An experimental study of focused very high energy electron beams for radiotherapy. Communications Physics. 2021 Feb 23;4(1):33.

[9] Arpaia P, Corsini R, **Gilardi A**, Mostacci A, Sabato L, Sjobak KN. Enhancing particle bunch-length measurements based on radio frequency deflector by the use of focusing elements. Scientific reports. 2020 Jul 10;10(1):11457.

[10] Curcio A, Bergamaschi M, Corsini R, Farabolini W, Gamba D, Garolfi L, Kieffer R, Lefevre T, Mazzoni S, Fedorov K, Gardelle J, **Gilardi A**. Noninvasive bunch length measurements exploiting Cherenkov diffraction radiation. Physical Review Accelerators and Beams. 2020 Feb 3;23(2):022802.

Conference/Workshop

[1] **Gilardi A**, Aksoy A, Bonnard L, Carranza-Garcia M, Corsini R, Farabolini F, Filippetto D, Franek O, Gamba D, Granados E, Korysko P, Malyzhenkov A, Mazzoni S, Mostacci A , Petersson A, Pollastro A, Rieker V, Sjøbæk KN, Tangari G, Wroe LM. Beam Energy Forecasting using Machine Learning at the CLEAR accelerator. IPAC25, 2025:10.18429/JACowW-IPAC2025-THPM031.

[2] **Gilardi A**, Aksoy A, Bonnard L, Carranza-Garcia M, Corsini R, Farabolini F, Foldesi LA, Filippetto D, Franek O, Gamba D, Granados E, Kain V, Korysko P, Malyzhenkov A, Mostacci A., Mazzoni S, Mostacci A, Rodriguez Mateos B, Petersson A, Pollastro A, Rieker V, Schenk M,Sjøbæk KN, Tangari G, Wroe LM. Toward Autonomous Control: Reinforcement Learning for Improving accelerator performance in CLEAR. IPAC25, 10.18429/JACowW-IPAC2025-THPM032.

[3] Petersson A, Aksoy A, Bonnard L, Corsini R, Farabolini W, Franek O, Gamba D, Granados E, **Gilardi A**, Korysko P, Malyzhenkov A, Rieker V, Sjøbæk KN, Tangari G, Wroe LM. Advanced beam tuning and beam measurements techniques in the CLEAR facility. IPAC25, 10.18429/JACowW-IPAC2025-TUPM026.

[4] Corsini R, Farabolini W, Gamba D, **Gilardi A**, Aksoy A, Franek O, Korysko P, Malyzhenkov A,

Mazzoni S, Petersson A, Rieker V, Tangari G, Wroe LM. Granados E. The future of the CLEAR facility: consolidation, ongoing upgrades and its evolution towards future electron facilities at CERN. IPAC25, 10.18429/JACowW-IPAC2025-TUPM027.

[5] Korysko P, Dosanjh M, Corsini R, Farabolini R, Malyzhenkov A, Wroe LM, Rieker V, **Gilardi A**, Vozenin MC, Kacem H, Ollivier J, Kunz L. VHEE FLASH radiotherapy: cutting-edge research at CLEAR, the CERN linear electron accelerator for research. IPAC25, 10.18429/JACowW-IPAC2025-THPM002.

[6] Reissig M, Brundermann E, Funkner S, Grimm LL, Harer B, Niehues G, Ruprecht R, Muller AS, Corsini R, **Gilardi A**, Mazzoni S , Pakuza C, Schloegelhofer A, Lefevre T. First prototype measurements with an electro-optical bunch profile monitor for FCC-ee. IPAC25, 10.18429/JACowW-IPAC2025-THPS079.

[7] Ferrentino V, Carazo AB, Carlier FS, Dilly J, Fol E, **Gilardi A**, Hofer M, Horney SJ,Keintzel J, Le Garrec M, Maclean EH, Nissinen T, Persson T, Soubelet F, Tomás Garcia R, Van Goethem W, Wegscheider A, Cardona J, Arpaia P. LHC 2023 Ion optics commissioning. IPAC24, 10.18429/JACoW-IPAC2024-MOPC20

[8] **Gilardi A**, Peterson AO, Pollastro A, Mateos BR, Foldesi LA, Schenk M, Corsini R, Kain V (2025). Toward Autonomous Control: Reinforcement Learning for Improving accelerator performance in CLEAR. 5th ICFA Beam Dynamics Mini-Workshop on Machine Learning for Particle Accelerators. Senes E, **Gilardi A**, Farabolini W, Pakuza C, Burrows PN, Corsini R, Lefèvre T, Krupa M, Mazzoni S, Wendt M. JACoW: Beam Position Detection of a Short Electron Bunch in Presence of a Longer and More Intense Proton Bunch for the AWAKE Experiment. JACoW IBIC. 2021;2021:75-9.

[9] Arpaia P, Corsini R, **Gilardi A**, Sjobak KN. Beam–based alignment of the CLIC high-gradient X-Band accelerating structure using beam-screen. In2019 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) 2019 May 20 (pp. 1-6). IEEE.

[10] Cropp F, Musumeci P, Scheinker A, Filippetto D, **Gilardi A**, Paiagua S, Wang D. Toward machine learning-based adaptive control and global feedback for compact accelerators. InProceedings of 13th International Particle Accelerator Conference (IPAC'22), Bangkok, Thailand 2022 Jun. JACoW.