Academic Curriculum Vitae – Moritz Ploner

Personal Information

Name: Moritz Ploner

Education

- **2020 – B.Sc. in Electrical Engineering and Information Technology** (Grade: Good), Technical University of Vienna, Vienna, Austria. Thesis Title: "Performanceanalyse des Raster Image Prozessors ‚Harlequin Host Renderer V12.1' auf diversen Hardwareplattformen". Referee: Dr. Friedrich Bauer (Technical University of Vienna).
- **2022 – M.Sc. in Electrical Energy Engineering** (Grade: 110/110 cum laude), University of Bologna, Bologna, Italy. Thesis Title: "Reliability and performance investigations on direct bonded copper (DBC) layout encapsulation in power converter design for aerospace applications". Referee(s): Prof. Andrea Cavallini, Prof. Mattia Ricco, Prof. Federico Tramarin (University of Bologna).
- **2026 – Ph.D. in Advanced-Systems Engineering** (Grade: Cum laude), Free University of Bozen-Bolzano, Bozen, Italy. Thesis Title: "Wearable Flexible Platform for Electrochemical Detection of Cytokines in Sweat". Referee(s): Prof. Arben Merkoçi (Institut Català de Nanociència i Nanotecnologia), Prof. Lucio Pancheri (University of Trento), Dr. Serpil Tekoglu (Johannes Kepler University Linz).

Present Appointment

- **Researcher**, Free University of Bozen-Bolzano, Bozen, Italy. Research focus: Flexible and wearable electrochemical biosensors for real-time, non-invasive health and sports monitoring. Research activities include the design and fabrication of thin-film electrode arrays on flexible substrates, nanomaterial engineering, biofunctionalization, and microfluidic sampling systems. The work emphasizes multiplexed sensing of analytes in human biofluids, system-level integration of sensors with low-power electronics, and machine-learning-assisted signal processing to address physiological variability and low analyte concentrations, targeting sustainable and skin-conforming wearable devices.

Past Professional Experience

From / To	Job Title	Employer/ Academic Institution	Academic Level	Responsibilities
03/2020 – 06/2020	Electrical Engineer	Durst Phototechnik AG, Brixen, Italy	B.Sc.	Conducted bachelor thesis research: *"Performanceanalyse des Raster Image Prozessors ‚Harlequin Host Renderer V12.1' auf diversen Hardwareplattformen";* analyzed processor performance and evaluated file format handling for optimization.
01/2021 – 02/2021	Intern	Alpitronic GmbH, Bozen, Italy	M.Sc.	Developed MATLAB-based database for comparing semiconductor module losses.
02/2021 – 01/2022	Electrical Engineer (Part-time)	Alpitronic GmbH, Bozen, Italy	M.Sc.	Developed MATLAB programs to calculate power losses in circuit topologies. Developed testing system for PCB functionality verification.

02/2022 – 07/2022	Visiting Researcher	University of Connecticut, Mansfield, USA	M.Sc.	Conducted master thesis research: *"Reliability and performance investigations on DBC layout encapsulation in power converter design for aerospace applications"*. Developed and analyzed all-organic, paper-thin ferroelectret loudspeakers.
08/2022 – 09/2022	Intern	EUT Engineering GmbH, Brixen, Italy	M.Sc.	Assisted in design and planning of hydroelectric power plants.
01/2025 – 07/2025	Visiting Researcher	Microfluidics and Nanofluidics Research Laboratory, MIT, Cambridge, USA	Ph.D.	Designed microfluidic systems for continuous on-body sweat collection. Developed microbead-based isolation and sensing platforms for precise bacteria detection in foodborne pathogen monitoring.

Experience in Academic Teaching

<u>**Teaching at Free University of Bolzano-Bozen:**</u>
Academic year 2022/2023
- Teaching assistant for *Fundamentals of Electronics* (6 CFU) at the B.Sc. in Electronic and Cyber-Physical Systems Engineering (L-8).

Academic year 2023/2024
- Teaching assistant for *Fundamentals of Electronics* (6 CFU) at the B.Sc. in Electronic and Cyber-Physical Systems Engineering (L-8).
- Teaching assistant for *Electronic Circuit Design* (6 CFU) at the B.Sc. in Electronic and Cyber-Physical Systems Engineering (L-8);

Experience in Academic Supervision

At the Free University of Bozen-Bolzano, I have served as the secondary academic supervisor for 2 undergraduate students (B.Sc. degree) in their thesis work.

Memberships

Membership of Academic or Professional Bodies
- **Member** of the IEEE since 2022.
- **Member** of the IEEE Young Professionals (YP) since 2022.
- **Member** of the IEEE Electron Devices Society (EDS) since 2023.
- **Student Member** of the Materials Research Society (MRS) since 2024.
- **Student Member** of the Electrochemical Society (ECS) since 2025.

Research and Scholarships

Summary of Current Research and Scholarship
My research focuses on the development of sustainable thin-film electronics for wearable biosensing applications, with particular emphasis on flexible electrochemical sensors for continuous, real-time monitoring of biomarkers in externally accessible biofluids.
My work combines materials engineering, microfabrication, and system-level integration, including thin-film electrodes, nanomaterial functionalization, flexible substrates, and multi-channel data acquisition electronics. I also apply machine-learning techniques to improve signal reliability under low analyte concentrations and physiological variability. Current research directions include sensor regeneration strategies for extended device lifetime, investigation of correlations between sweat and blood analytes under stimulated conditions, and the development of low-

power, wireless electronic architectures for autonomous wearable operation. Overall, my work aims to advance robust, user-centric wearable biosensing platforms for health and sports monitoring applications.

Summary of Research and Scholarship During the Previous Five Years

From February to July 2022, I conducted my master's thesis at the University of Connecticut, USA, on Direct Copper Bond (DCB) layout encapsulation for high-voltage power converters in aerospace applications. I investigated partial discharge (PD) activity, optimized pad geometries, and evaluated substrate materials under varying pressures. This work combined experimental measurements with 3D finite element simulations and explored encapsulation using dielectric gels and liquids, providing insights into materials, design parameters, and electrical reliability.

During the same period, I developed an all-organic, flexible, and body-compatible loudspeakers for wearable electronics using ultrathin ferroelectret films with sputter-coated electrodes. I focused on optimizing flexibility, skin compatibility, and seamless integration into wearable systems, while characterizing frequency-dependent sound intensity, radiation directivity, and thermal stability.

Through these projects, I gained hands-on experience in sensor testing, modelling, and data analysis, building strong foundations in thin-film devices, flexible electronics, and system-level optimization.

From November 2022 until January 2026, I pursued my Ph.D. in Advanced-Systems Engineering at the Sensing Technologies Laboratory (STL) at the Free University of Bozen-Bolzano, Italy, and developed flexible thin-film electronics and wearable biosensing platforms in collaboration with Empatica Srl., a pioneer in AI-driven digital health monitoring.

The research focused on flexible, thin-film sensors and integrated biosensing platforms capable of real-time, minimally-invasive monitoring of cytokines in sweat. Key contributions included the design, fabrication, and biofunctionalization of gold nanoparticle-aptamer-functionalized electrodes, development of multiplexed sensor arrays, and integration with flexible microfluidic platforms for continuous sweat sampling. Electrochemical optimization was guided by simulation-assisted design, while machine learning algorithms enhanced detection accuracy at the pg/mL scale. Additionally, a flexible iontophoretic platform was developed for on-demand sweat collection, supporting real-time, wearable-compatible monitoring.

This work was highly collaborative, leveraging partnerships with Empatica Srl., Fondazione Bruno Kessler (FBK), Technical University of Dresden, University of Padova, University of Parma, MIT, and the Technical University of Istanbul. These collaborations provided access to advanced fabrication, characterization, and simulation facilities, enabling the development of fully integrated wearable sensing platforms.

Collectively, this research combineed materials engineering, electronics, and system-level integration, establishing expertise in thin-film devices, flexible electronics, and bioelectronic systems for health monitoring in wearable applications.

Publications

Journal Articles in Refereed Academic Journals (Main Author(s) in Italics)

- (*)***M. Ploner***, *N. Wang*, C. Wu, R. Daniels, J. Huo, G. A. Sotzing, and Y. Cao, „Ultrathin, All-Organic, Fabric-Based Ferroelectret Loudspeaker for Wearable Electronics", iScience, vol. 25, no. 12, 2022, doi: 10.1016/j.isci.2022.105607. Impact Factor: 4.1; Quartile: Q1; Citations (Feb 2026): 4

- *T. Shahsavarian*, **M. Ploner**, K. Davis-Amendola, B. Chislea, J. McKeen, D. Zhang, A. Cavallini, and Y. Cao, „Unveiling Insights Into Partial Discharge and Design and Encapsulation Challenges in DCB-Based Power Converters for Aerospace Applications", IEEE Access, vol. 12, pp. 125735–125750, 2024, doi: 10.1109/ACCESS.2024.3442016.
  Impact Factor: 3.6; Quartile: Q1/Q2; Citations (Feb 2026): 1

- (*)***M. Ploner***, M. Petrelli, B. Shkodra, A. Tagliaferri, P. Lugli, D. Resnati, L. Petti, and M.A. Costa Angeli, „A comprehensive review on electrochemical cytokine detection in sweat", Cell Reports Physical Science, vol. 5, 2024, doi: 10.1016/j.xcrp.2024.101985.
  Impact Factor: 7.3; Quartile: Q1; Citations (Feb 2026): 17

- ***M. Ploner***, B. Shkodra, A. Altana, M. Petrelli, A. Tagliaferri, D. Resnati, P. Lugli, M.A. Costa Angeli, and L. Petti, „Flexible Electrochemical Sensor for Interleukin-6: Towards Wearable Cytokine Monitoring", *IEEE Sensors Letters*, vol. 9, 2024, doi: 10.1109/LSENS.2024.3429627.
  Impact Factor: 2.2; Quartile: Q2; Citations (Feb 2026): 14

- *A. Altana*, B. Shkodra, P. Ibba, M.A. Costa Angeli, **M. Ploner**, M. Petrelli, E. M. Korek, P. Lugli, and L. Petti, „Textile-Integrated Organic Electrochemical Transistor for Selective Ion Detection via Electrical Impedance Spectroscopy", *IEEE Sensors Letters*, vol. 9, 2024, doi: 10.1109/LSENS.2024.3414851.
  Impact Factor: 2.2; Quartile: Q2; Citations (Feb 2026): 13

- (*)***M. Ploner***, B. Shkodra, L. Franchin, A. Altana, M. Petrelli, M.A. Costa Angeli, G. Ciccone, T. Antrack, L. Vanzetti, R. Rajendran Nair, R. Canteri, S. Bonaldo, A. Paccagnella, H. Kleemann, D. Resnati, P. Lugli, A. Erten, and L. Petti, „Flexible Microfluidics-Integrated Electrochemical System for Detection of Tumor Necrosis Factor-Alpha under Continuous Flow of Sweat", *Biosensors and Bioelectronics*, vol. 287, 2025, doi: 10.1016/j.bios.2025.117734.
  Impact Factor: 10.5; Quartile: Q1; Citations (Feb 2026): 6

- (*)***M. Ploner***, M. Stighezza, B. Shkodra, V. Bianchi, T. Antrack, L. Vanzetti, R. Canteri, D. Resnati, A. Boni, I. De Munari, P. Lugli, and L. Petti, „Machine Learning-Enhanced Flexible IL-6 Sensor for Rapid Threshold Detection", *IEEE Sensors Journal*, 2025, doi: 10.1109/JSEN.2025.3607509.
  Impact Factor: 4.5; Quartile: Q1; Citations (Feb 2026): /

- *B. Shkodra*, S. De Pra, A. Altana, M. Petrelli, **M. Ploner**, M.A. Costa Angeli, L. Petti, S. Carrara, and P. Lugli, „Flexible Memristive Biosensors for Sensitive Detection of Prostate-Specific Antigen in Biological Environments", *IEEE Sensors Journal*, vol. 25, 2025, doi: 10.1109/JSEN.2025.3528755.
  Impact Factor: 4.5; Quartile: Q1; Citations (Feb 2026): 2

- ***M. Ploner, L. Franchin***, A. Altana, B. Shkodra, M. Petrelli, M.A. Costa Angeli, M. Pompilio, G. Elli, F. Cacialli, A. Paccagnella, D. Resnati, P. Lugli, S. Bonaldo, and L. Petti, „Enhancing Screen-Printed Electrode Performance through Simulation-Driven Design Optimization for Wearable Applications", *IEEE Journal on Flexible Electronics (J-FLEX)*, 2025, doi: 10.1109/JFLEX.2025.3628346.
  Impact Factor: /; Quartile: Q2; Citations (Feb 2026): /

Refereed Conference Proceedings (Main Author(s) in Italics)

- ***M. Ploner,*** L. Franchin, A. Altana, B. Shkodra, M. Petrelli, D. Resnati, A. Paccagnella, S. Bonaldo, P. Lugli, and L. Petti, "Electrochemical Transducer Optimization for Miniaturization and

Performance Enhancement for Wearable Cytokine Biosensors," 2024 IEEE International Flexible Electronics Technology Conference (IFETC), Bologna, Italy, 2024, doi: 10.1109/IFETC61155.2024.10771898.
Citations (Feb 2026): 5

- *L. Franchin*, **M. Ploner**, A. Altana, B. Shkodra, M. A. Costa Angeli, P. Lugli, L. Petti, A. Paccagnella, and S. Bonaldo, "Multiphysics Simulations of Cyclic Voltammetry Response of Flexible Screen-Printed Electrodes for Wearable Sensing Systems," 2024 IEEE International Conference on Flexible and Printable Sensors and Systems (FLEPS), Tampere, Finland, 2024, doi: 10.1109/FLEPS61194.2024.10604011.
Citations (Feb 2026): 4

- *B. Shkodra*, M. Petrelli, A. Altana, **M. Ploner**, L. Petti, S. Carrara, and P. Lugli, "Organic Memristive Devices with Capacitive-Coupled Effect: A Novel Approach for Histamine Sensing," 2024 IEEE BioSensors Conference (BioSensors), Cambridge, UK, 2024, doi: 10.1109/BioSensors61405.2024.10712669.
Citations (Feb 2026): 2

- *A. Tagliaferri*, B. Shkodra, M. A. Costa Angeli, **M. Ploner**, M. Petrelli, A. Altana, P. Ibba, P. Lugli, and L. Petti, "Stability and Functionalization of Carbon Nanotube Electrolyte-Gated Field-Effect Transistors," Annual Meeting of the Italian Electronics Society, Genoa, Italy, 2024, doi: 10.1007/978-3-031-71518-1_28.
Citations (Feb 2026): 1

- ***M. Ploner***, M. Petrelli, A. Rasheed, G. Elli, B. Shkodra, D. Resnati, P. Lugli, and L. Petti, "Electrochemical Devices for Sweat-Based Health and Sports Monitoring," 2025 Device Research Conference (DRC), Durham, USA, 2025, doi: 10.1109/DRC66027.2025.11105735.
Citations (Feb 2026): /

- ***M. Ploner***, B. Schmied Ties, A. Gurusekaran, G. Elli, and L. Petti, "Advancing On-Demand Sweat Biosensing via a Flexible Iontophoretic Platform," 2025 IEEE Sensors Conference, Vancouver, Canada, 2025, doi: 10.1109/SENSORS59705.2025.11330379.
Citations (Feb 2026): /

Publications About the Applicant	- Unibz magazine – "unibz students awarded at the IEEE IFETC 2024 Conference in Bologna" - https://www.unibzmagazine.it/de/magazine/article/unibz-students-awarded-at-the-ieee-ifetc-2024-conference-in-bologna - Unibz magazine – "Von Villanders ans MIT" - https://www.unibzmagazine.it/de/magazine/article/von-villanders-ans-mit
Participation in Exhibitions, Third Mission Activities, and Awards	**Exhibitions and Third Mission Activities** - Participated in the festival "**Le mille e una Scienza**" 2022, Free University of Bozen-Bolzano, Bozen, Italy, November 2022. - Participated in "**Rendezvous mit dem Traumberuf**," Free University of Bozen-Bolzano, Bozen, Italy, October 2023. - Participated in the festival "**Science Live. Get Curious!**", Free University of Bozen-Bolzano, Bozen, Italy, October 2023. - Participated in "**Open Day for Schools**," NOI Techpark Bozen, Bozen, Italy, November 2023. - Participated in "**Unibz STEM School**," Free University of Bozen-Bolzano, Bozen, Italy, February 2024.

- Participated in "**Lvh.apa techParcour Handwerk,**" NOI Techpark Bozen, Bozen, Italy, February 2024.
- Supervised two **PCTO (Percorsi per le Competenze Trasversali e per l'Orientamento) student internships** at NOI Techpark Bozen and the Free University of Bozen-Bolzano, Bozen, May–July 2024.
- Organized and conducted a teacher training seminar on **"Sensor Technologies (Sensorentechnik)"**, as part of the continuing education program of the Pedagogical Department of the Autonomous Province of Bozen. NOI Techpark Bozen, Bozen, Italy, October 2025.
- Conducted multiple laboratory tours for high and middle school classes. NOI Techpark Bozen and the Free University of Bozen-Bolzano, Bozen, Italy, 2022–2025.

Awards

- Awarded with the **Premio al Merito 2023** for academic excellence and community contributions, University of Bologna, Bologna, Italy, 2023.
- Awarded with the **Student Best Paper Award (3rd place)** at the 2024 IEEE International Conference on Flexible and Printable Sensors and Systems (FLEPS), Tampere, Finland, 2024.
- Awarded with the **Best Oral Contribution Award** at the 2024 IEEE International Flexible Electronics Technology Conference (IFETC), Bologna, Italy, 2024.
- Awarded with the Materials Research Society (MRS) **Graduate Student Silver Award** at the MRS Fall Meeting 2024, Boston, USA, 2024.
- Awarded with the 2025 **IEEE Sensors Letters Best Paper Runner-Up Award**, Vancouver, Canada, 2025.

Contributed and Invited Presentations at Scientific Conferences

Contributed Presentations (Presenting Author in Italics):
- *M. Ploner,* L. Franchin, A. Altana, B. Shkodra, M. Petrelli, D. Resnati, A. Paccagnella, S. Bonaldo, P. Lugli, and L. Petti, "Electrochemical Transducer Optimization for Miniaturization and Performance Enhancement for Wearable Cytokine Biosensors", 2024 IEEE International Flexible Electronics Technology Conference (IFETC), Bologna, Italy, September 2024.
- *M. Ploner*, B. Shkodra, A. Altana, M. Petrelli, A. Tagliaferri, D. Resnati, P. Lugli, M.A. Costa Angeli, and L. Petti, „Flexible Electrochemical Sensor for Interleukin-6: Towards Wearable Cytokine Monitoring", 2024 IEEE Sensors Conference, Kobe, Japan, October 2024.
- *M. Ploner*, B. Shkodra, L. Franchin, A. Altana, M. Petrelli, A. Tagliaferri, D. Resnati, A. Paccagnella, S. Bonaldo, P. Lugli, M.A. Costa Angeli and L. Petti, "Elevating Healthcare: Flexible Electrochemical Sensing of Cytokines in Sweat for Wearables", 2024 MRS Fall Meeting, Boston, USA, December 2024.

Invited Presentations (Presenting Author in Italics):
- **M. Ploner**, M. Petrelli, A. Rasheed, G. Elli, B. Shkodra, D. Resnati, P. Lugli, and *L. Petti*, "Electrochemical Devices for Sweat-Based Health and Sports Monitoring", 2025 Device Research Conference (DRC), Durham, USA, June 2025.
- **M. Ploner**, M. Stighezza, B. Shkodra, V. Bianchi, M. Caselli, D. Resnati, A. Boni, P. Lugli, I. De Munari and *L. Petti*, "AI-Enhanced Flexible Interleukin 6 Sensor: Smart Detection for Early Disease Alerts", MRS Spring 2025, Seattle, USA, April 2025.

Language Competence	German: Native
	Italian: B2
	English: C2

03/02/2026   Moritz Ploner