Università di Catania

GaN4AP

International GaN4AP Workshop

GaN for Advanced Power Applications

ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

Catania (Italy), Monastero dei Benedettini - February 20-21, 2025

Summary

Welcome to the International GaN4AP Workshop: GaN for Advanced Power Applications

On behalf of the Organizing Committee, we are delighted to welcome you to the **International GaN4AP Workshop: GaN for Advanced Power Applications**.

The workshop is a scientific forum bringing together leading experts from academia, research institutions, and industry, all working across diverse areas of **gallium nitride (GaN) technology** and **power electronics applications**.

The workshop will focus on cutting-edge developments in advanced technologies, innovative materials, and GaN-based solutions for power converters, fostering discussions that bridge research and real-world applications.

The event is organized within the framework of the European project "**GaN for Advanced Power Applications (GaN4AP)**". This unique feature will enable the interaction of different communities working on complementary aspects of GaN technology, thus being an efficient driving force for the further development of GaN research in Europe.

Thank you for joining us, and we look forward to a productive and engaging event!

General Co-Chairs

Giacomo Scelba and Gianluca Giustolisi

The GaN4AP Workshop Organizing Committee would like to express its gratitude for the generous support received from the following:

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Invited Lectures

Francesco Iannuzzo is a professor of reliable power electronics with the Power Electronics Innovation Center at Politecnico di Torino, Italy. He is the author or co-author of over 300 publications in journals and international conferences, five book chapters, and has edited a book on Modern Power Electronic Devices. He has given over 30 technical seminars and keynotes, and several invited speeches to top-tier conferences such as ISPSD, IRPS, EPE, ECCE, PCIM, and APEC in the field of reliability of power electronic devices.

Oliver Hilt received the Ph.D. degree in experimental physics from Free University Berlin, Germany, in 1995, for his work on the delocalized charge transport in liquefied rare gases, which was performed at the Hahn-Meitner-Institut Berlin, Berlin. For his postdoctoral work with Delft University of Technology and Leiden University, both The Netherlands, he analyzed the charge transport mechanisms in organic conductors and semiconductors. In 1999, he joined sglux GmbH, Berlin, to develop and commercialize a titanium-dioxide-based wide-band-gap ultraviolet photodiode, where he acted as CEO since 2003. In 2006, he joined the Ferdinand-Braun-Institut (FBH), Berlin, for the development of GaN-based switching transistors for high-voltage power applications. Since 2022, he is Head of the Wide-Bandgap Electronics Department and works on RF- and power devices based on GaN, AlN and Ga2O3.

Alfio Russo is Senior Business and Technical Advisor of the Analog Sub-Group and has held this position since January 2025. Russo joined the Marketing Department of SGS-Thomson Microelectronics (now STMicroelectronics) in 1988 in the role of VIPower Technical Marketing Engineer. From 2001, on top of the technical marketing role, was appointed as Key Strategic Alliances Manager and then promoted to Director in 2007. From 2009 to 2011, Russo led the Power Product Management and Body & Power Marketing & Application in the role of Director with special focus on Automotive and Industrial market segments. He gained the position of Body and Audio Division General Manager in 2012 and promoted to Automotive Group Vice President in 2014. In 2020 he moved in the position of Group VP - Low Voltage & ST i^2GaN Solutions Macro-Division General Manager. In 2018 he received the Star of Merit of Labor with the title of Master of Labor. Alfio Russo was born in Acireale, Italy, in 1960, and graduated with a degree in Electric Engineering from the University of Catania in January 1987.

Danilo Falchi is an advanced development project Manager at Valeo Power Division - Valeo Electrification in FRANCE. Graduate of Mechanical Engineer from Polytechnic of Turin - Italy in 2005, during his 20 years of automotive experience, he worked in several innovative technology like: EGR , Bypass , Throttle valve, Camless (eValve) , eDOD (electric disconnection on demand) , Cooling themis Valves and now in the GaN technology for LV and HV products. He is co-author of over more than 40 international patents. He participated at several technical seminars, funded projects and speaker in conferences like Nanoinnovation.

Frédy Poirier is an engineer and working as collaborative project manager at VALEO Power division in France (a global automotive supplier, developing and providing advanced technology solutions related to energy management and electrification for vehicles). He started his career in automotive industry in 2000 and integrated VALEO in 2011 participating to several industrial projects as Quality Engineer. Since 2023, he is coordinating the VALEO collaborative projects like GaN4AP who he is Work Package 6 leader (demonstrator) on this project.

Program at Glance

CET	20.02.2025 Thursday
08:45 – 09:15	Welcome and opening
09:15 – 09:45	Invited Lecture – Francesco Iannuzzo (Politecnico di Torino) *"Testing for reliability of modern GaN devices: status and prospects"*
09:45 – 10:50	**Session 1:** *Devices characterization, modelling and reliability*
10:50 – 11:20	Coffee break
11:20 – 12:20	**Session 2:** *GaN-based devices and Integrated GaN Solutions*
12:20 – 13:20	**Session 3:** *GaN Systems: Modelling, Testing & Reliability*
13:20 – 14:20	Lunch
14:20 – 14:50	Invited Lecture – Oliver Hilt (Ferdinand-Braun-Institut) *"Towards 1200 V power-switching in vertical GaN and lateral AlN device technologies"*
14:50 – 15:50	**Session 4:** *GaN-based materials and heterostructures growth and characterization*
15:50 – 16:20	Coffee break
16:20 – 17:20	**Poster Session 1 (**Posters can be set up in the morning and will remain on display until the conclusion of the poster session)
17:30 – 18:30	Guided Tour to the Benedictine Monastery
20:00	Gala Dinner

CET	21.02.2025 Friday
09:00 – 09:30	Invited Lecture – Danilo Falchi and Fredy Poirier (Valeo Electrification) *"Trends for future automotive power electronics"*
09:30 – 10:00	Invited Lecture – Alfio Russo (STMicroelectronics) *"Exploiting the best of Silicon and GaN integration"*
10:00 – 10:30	Coffee break
10:30 – 11:30	**Session 5:** *Advanced Topologies and Control Strategies for GaN-based Power Converters*
11:30 – 12:30	**Poster Session 2 (**Posters can be set up in the morning and will remain on display until the conclusion of the poster session)
12:30 – 12:40	Conclusions
12:40 – 13:40	Lunch

General Information

- Attendees have full access to Wi-Fi: Username: **GaN4AP**, Password: **Welcome_CT_for_Gan4AP!**
- The gala dinner will be held at **Acqualavica restaurant**, Via Cardinale Dusmet, 35 (see map below) on Thursday February 20, at 20:00.

Technical Program

Thursday, February 20

08:45 Welcome and opening

09:15 I INVITED LECTURE "Testing for reliability of modern GaN devices: status and prospects"
F. Iannuzzo - *Politecnico di Torino*

Chair: *Giacomo Scelba (University of Catania)*

09:45 I IEEE ITALY SECTION JOINT CHAPT. IAS/PELS C&S - activities for power electronics (open participation)
M. Cacciato *(University of Catania) – A. Laudani (University of Catania)*

SESSION 1 - *Devices characterization, modelling and reliability*

Chair: Mario Cacciato *(University of Catania)*

09:50 | "Low Temperature TDSB Lifetime Evaluation of GaN HEMT Devices" [ID17]
M. Finocchiaro, E. Schroer, L. Anoldo, A. Russo
STMicroelectronics

10:05 | "Material and Process related defects in GaN-on-GaN vertical devices" [ID44]
M. Dagher, G. Brémond, C. Sonneville, H. Haas, M.R. Iretki, J. Buckley, V. Maurya, M. Charles, J.M. Bluet
INSA Lyon

10:20 | "Pulsed Performance Analyses of AlGaN/GaN HEMTs with Iron-Doped Buffer Using Experimental and TCAD Approaches" [ID36]
F. Ercolano, L. Balestra, S. Krause, S. Leone, P. Waltereit, M. Dammann, I. Streicher, S. Reggiani
University of Bologna, Fraunhofer IAF

10:35 | "On-Wafer Gate Pre-Reliability Study in 650V p-GaN HEMTs" [ID07]
G. Giorgino, C. Miccoli, M. Cioni, S. Reina, T. Wakrim, G. Luongo, V. Guillon, Y. Sama, P. Gaillard, M. Zeghouane, H. Chauveau, M. E. Castagna, A. Constant, F. Iucolano, A. Chini.
University *of Modena and Reggio Emilia, STMicroelectronics*

10:50 Coffee Break

SESSION 2 - *GaN-based devices and Integrated GaN Solutions*

Chair: Gaudenzio Meneghesso (*University of Padova)*

11:20 | "Gate current transport and degradation mechanisms in p-GaN-gate HEMTs" [ID06]
G. Greco, P. Fiorenza, M. Vivona, F. Giannazzo, G. Giorgino, C. Miccoli, E. Castagna, C. Venuto, F. Iucolano, F. Roccaforte
CNR-IMM, STMicroelectronics

11:35 | "Monolithic GaN system evolution for power conversion" [ID09]
C. Bimbi, F. Pulvirenti, S. Privitera
STMicroelectronics

11:50 | "Performance Assessment of DC Solid-State Circuit Breakers with GaN HEMTs" [ID28]
A. R. Figueiredo Bento, F. Bento, A. J. Marques Cardoso
CISE – Electromechatronic Systems Research Centre

12:05 | "Three-Channel Fully Integrated Galvanic Isolation Interface in GaN Technology " [ID38]
K. Samperi, R. Sessa, N. Spina, S. Pennisi, G. Palmisano
University of Catania, STMicroelectronics

SESSION 3 - *GaN Systems: Modelling, Testing & Reliability*

Chair: Gianluca Giustolisi *(University of Catania)*

12:20 | "Simulation and Experiment Based Study of Enhancement Mode GaN-HEMT Parallelization for Hard-Switching Automotive Traction Inverter Application" [ID13]
M. Farhan Tayyab, A. Bucher, B. Lunz, T. Basler
Valeo eAutomotive Germany GmbH, Chemnitz University of Technology

12:35 | "GaN power module for dynamic characterisation" [ID15]
L. Sterna, G. Perez, R. Escoffier, R. Gwoziecki, S. Lesecq
Commissariat à l'Energie Atomique

12:50 | "Accurate Simulation of PCB parasitic effects in Fast Switching Circuits by Means of Electromagnetic Analysis and Digital Twin Approach" [ID49]
G. Calbi, F. Palomba, L. Eichinger, F. Gennaro, G. Aiello, M. Pavone
Keysight Technologies, STMicroelectronics

13:05 | " Evaluation of GaN transistors for grid connected 3-level T-type inverters" [ID16]
J. Endres, T. Haas, A. Wist, O. E. Alvarez, A. Pawellek, V. Kremer
Technical University of Applied Sciences Würzburg-Schweinfurt, Schneider Electric

13:20 Lunch

14:20 INVITED LECTURE "Towards 1200 V power-switching in vertical GaN and lateral AlN device technologies"
O. Hilt - *Ferdinand-Braun-Institut*
Chair: *Yvon Cordier (CRHEA-CNRS)*

SESSION 4 - ***GaN-based materials and heterostructures growth and characterization***
Chair: Filippo Giannazzo *(CNR-IMM)*

14:50 | "Ammonothermal Growth of GaN and Substrate Fabrication Processes" [ID02]
M. Bockowski, M. Zak, T. Sochacki, M. Amilusik, A. Puchalski, K. Grabianska, P. Kempisty, R. Kucharski
Institute of High-Pressure Physics Polish Academy of Sciences

15:05 | "A Comparison Study of Substrates Quality for GaN Vertical Devices" [ID23]
P. F. P. P. Rocha, K. Nadaud, G. Greco, T. Slimani Tlemcani, M.l Bockowski, F. Bartoli, E. Frayssinet, Y. Cordier, F. Roccaforte, D. Alquier
Universitè Tours and GREMAN, CNR-IMM, CNRS CRHEA, Institute of High-Pressure Physics Polish Academy of Sciences

15:20 | "AlYN and AlScN: from the growth to the device and future applications" [ID19]
I. Streicher, T. Duarte, P. Straňák, L. Kirste, K. Nomoto, D. Jena, R. Quay, S. Leone
CNR-IMM, Fraunhofer IAF, School of Electrical and Computer Engineering

15:35 | "Structural and electrical properties of AlScN/GaN HEMTs grown by ammonia source molecular beam epitaxy" [ID10]
C. Elias, S. Chenot, M. Nemoz, F. Bartoli, A. Courville, V. Gallardo Mödinger, P. Vennéguès, M. Hugues, Y. Cordier, D. Alquier, T. Slimani Tlemcani, M. Bah, M. Zhang, F. Roccaforte, G. Greco, P. Fiorenza
CNR-IMM, Universitè Tours and GREMAN, CNRS CRHEA

15:50 Coffee Break

16:20 – 17:20 | Poster SESSION 1 (Posters can be set up in the morning and will remain on display until the conclusion of the poster session)
Chairs: Luigi Tornello (*University of Catania),* Giovanni Susinni (*EDA Industries),* Daniela Cavallaro *(Nexperia)*

"Impact of SiN Passivation on dynamic R_{ON} degradation on 100 V p-GaN gate AlGaN/GaN HEMTs" [ID03]
G. Cappellini, M. Cioni, G. Giorgino, G. Luongo, M. Moschetti, A. Chini, C. Miccoli, M. E. Castagna, F. Iucolano
STMicroelectronics, University of Modena and Reggio Emilia

"Schottky contacts on GaN epilayers grown on ammonothermal substrates" [ID04]
F. Roccaforte, G. Greco, P. Fiorenza, S. Di Franco, E. Schilirò, R. Lo Nigro, F. Giannazzo, T. Slimani Tlemcani, E. Frayssinet, F. Bartoli, M. Bockowski, D. Alquier, Y. Cordier
CNR-IMM, Universitè Tours and GREMAN, CNRS CRHEA, Institute of High-Pressure Physics

"Dynamic ON Resistance Variations of Power GaN Devices ON SALT and DHTOL Tests" [ID05]
S. Barone, A. Polpetta, S. A. Rizzo, G. Susinni
EDA Industries, University of Catania

"Back-Bias Degradation on AlGaN/GaN TLM-Structures: Bias-Increased Trap Emission in Buffer Layers" [ID08]
D.M. Lombardo, C. Miccoli, A. Chini, G. Giorgino, A. Parisi, M. E. Castagna, F. Iucolano
STMicroelectronics, University of Modena and Reggio Emilia

"Novel solution for the deposition of highly n-doped GaN by PVD technology from a liquid gallium target" [ID39]
T. Tschirky, M. Rechsteiner, M. Elghazzali, P. Döring
Evatec AG, Fraunhofer IAF

"Vertical 2D/3D heterojunction diodes by large area MoS2 integration with bulk GaN " [ID12]
F. Giannazzo, S. E. Panasci, E. Schilirò, G. Greco, P. Fiorenza, F. Roccaforte, G. Sfuncia, G. Nicotra, E. Frayssinet, Y. Cordier, A. Koos, B. Pècz
CNR-IMM, CNRS CRHEA, HUN-REN Centre for Energy Research

"Monolithic 100V p-GaN Linear Voltage Regulator" [ID18]
G. Sicurella, M. La Rosa, A. Gambero, S. Rossi
STMicroelectronics

"Ohmic contacts to AlScN/GaN heterostructures" [ID20]
I. Streicher, G. Greco, T. Duarte, L. Kirste, P. Straňák, S. Di Franco, V. Votadoro, F. Giannazzo, S. Leone, F. Roccaforte
CNR-IMM, Fraunhofer IAF

"Integrated Smart GaN for compact and robust 48V-12V Conversion" [ID21]
G. D'Agata, F. Cammarata
STMicroelectronics

"Advancements in Scandium-Precursor Development for MOCVD Applications" [ID48]
M. Kapitein, M.Balmer, O. Briel, P. Ludewig, J. Koch
Dock Chemicals

“Comparative Analysis of Multilevel Inverters for Electric Traction Applications” [ID27]
A. Di Cataldo, S. Foti, G. Scelba, A. Testa, M. Cacciato, G. Scarcella, T. Scimone, S. De Caro, G. Aiello, F. Gennaro
University of Catania, University of Messina, STMicroelectronics

“Three-Stage Operational Amplifier in GaN-IC SOI Technology” [ID29]
K. Samperi, U. Chatterjee, S. Pennisi
University of Catania, IMEC

“Investigation of Defects Generation on Self-Heating of GaN HEMTs” [ID30]
K. Ahmeda, B. Ubochi, B. Benbakhti, M. Elksne, W. Abushiba, E. Wasige, K. Kalna
Dynex Semiconductor, The Federal University of Technology, University of Mostaganem, University of Latvia, Applied Science University, University of Glasgow, Swansea University

“Charge trapping processes in Vertical GaN Trench MOSFETs ” [ID50]
M.l Fregolent, L. Cappelletto, C. De Santi, E. Bahat Treidel, E. Brusaterra, O. Hilt, G. Meneghesso, E. Zanoni, M. Meneghini
University of Padova, Ferdinand-Braun-Institut

17:30 – 18:30 Guided Tour to the Benedictine Monastery

20:00 GALA DINNER (Acqualavica restaurant**)**

Friday, February 21

09:00 INVITED LECTURE "Trends for future automotive power electronics"
D. Falchi, F. Poirier – *Valeo Electrification*
Chair: *Costantino Giaconia (University of Palermo)*

09:30 INVITED LECTURE "Exploiting the best of Silicon and GaN integration"
Alfio Russo – *STMicroelectronics*
Chair: *Antonio Testa (University of Catania)*

10:00 Coffee Break

SESSION 5 - *Advanced Topologies and Control Strategies for GaN-based Power Converters*
Chair: Francesco Gennaro *(STMicroelectronics)*

10:30 | "An ordinary harmonic current mitigation method utilizing a PLL-based repetitive control approach for grid connected voltage source inverters " [ID14]
S. Decker, A. Schwaegerl, L. Schuler
Schneider Electric Automation GmbH, Technical University of Applied Sciences Würzburg-Schweinfurt

10:45 | "Active and Passive Components Frequency Performance for a GaN-Based Two-Phase Interleaved Buck Converter" [ID45]
G. Galioto, G. C. Giaconia, G. Chiarello, G. Vitale, G. Lullo
University of Palermo, CNR ICAR

11:00 | "Methodology for designing broadband DC-link filters for voltage source converters " [ID11]
S. Raab, S. Weickert, H. Kasten
Technical University of Applied Sciences Wuerzburg-Schweinfurt, Germany

11:15 | "GaN-based PFC Power Supply: Towards Miniaturization and High Efficiency " [ID22]
M. Torrisi, S. Messina, M. Cacciato
STMicroelectronics, University of Catania

11:30 – 12:30 | Poster SESSION 2 (Posters can be set up in the morning and will remain on display until the conclusion of the poster session)
Chairs: Tommaso Scimone *(University of Catania),* Salvatore Foti *(University of Messina),* Elena Venuti *(Technoprobe)*

"In situ study of the 2D Electron Gas in p-GaN/AlGaN/GaN High Electron Mobility Transistor" [ID32]
G. Sfuncia, C. Bongiorno, K. Bottari, S. Adamo, S. Alessandrino, G. Nicotra
CNR IMM, STMicroelectronics

"Time Domain Investigation of Dynamic ON-Resistance and Trapping Effects in GaN-on-Si HEMTs under Rectangular Gate Voltage Pulses" [ID33]
P. Cusumano, A. Sirchia, F. Vella
University of Palermo

"Evaluation of Hysteresis and Charge Trapping in GaN on Si HEMTs Using Triangular Gate Voltage Pulses" [ID34]
P. Cusumano, F. Vella, A. Sirchia
University of Palermo

"Enhancing Efficiency of Power Converters for Electric Traction Using GaN-based Hybrid Topology" [ID35]
S. Foti, G. Baia, S. De Caro, A. Testa, G. Scelba
IUSS Advanced School of Pavia, University of Messina, University of Catania,

"Losses estimation in a 250W Adapter design - GaN vs Si technologies" [ID37]
A. Giordano, M. Torrisi, S. Messina, D. Sfilio, M. Cacciato
STMicroelectronics, University of Catania

"Cost Effective 300W GaN Based Inverter: Compact, Heatsink-Free Design for self-sensing Three-Phase Motor Control for Household Fridge Compressor" [ID40]
G. Forte, A. Spampinato
STMicroelectronics

"Experimental Characterization and Modeling of RF Performance of GaN-on-Si Power e-HEMTs Including Temperature Effects" [ID41]
M. Santaluna, V. Sottile, A. Busacca, E. Calandra, L. Curcio, G. C. Giaconia, A. Parisi, R. Pernice, S. Stivala
University of Palermo

"GaN galvanic isolation interface based on chip-to-chip RF communication" [ID42]
R. Sessa, N. Spina, K. Samperi, G. Palmisano
STMicroelectronics, University of Catania

"Optimization of Vertical GaN-on-Si Trench MOSFETs for Power Applications: A Numerical Simulation Study" [ID43]
N. Zagni, G. Verzellesi, A. Chini
University of Modena and Reggio Emilia

"Analysis of PCB Design for T-NPC Inverter with Parallel GaN Devices Using S-Parameters and SPICE Simulation" [ID26]
V. Kremer, R. Franchino, R. Mitova, J. Endres
Schneider Electric, Technical University of Applied Sciences Würzburg-Schweinfurt
"Extremely compact 1W module for GaN driver " [ID31]
A. Russo
STMicroelectronics
“GaN based converter for Cloud” [ID46]
M. G. Trifiro’, G. Mangraviti, G. Scelba
Renesas Electronics, University of Catania
“Nearly-ideal Molybdenum Schottky contacts on AlGaN/GaN heterostructures” [ID47]
S. Milazzo, G. Greco, S. Mirabella, F. Iucolano, F. Roccaforte
University of Catania, CNR-IMM, STMicroelectronics
“Design, S-parameters characterization and modelling of coreless inductor for a GaN-based 1-MHz synchronous buck converter” [ID25]
G. Galioto, E. Calandra, G. C. Giaconia, G. Vitale, G. Lullo, D. Sciré
University of Palermo, CNR ICAR

12:30 Conclusions

12:40 – 13:40 Lunch

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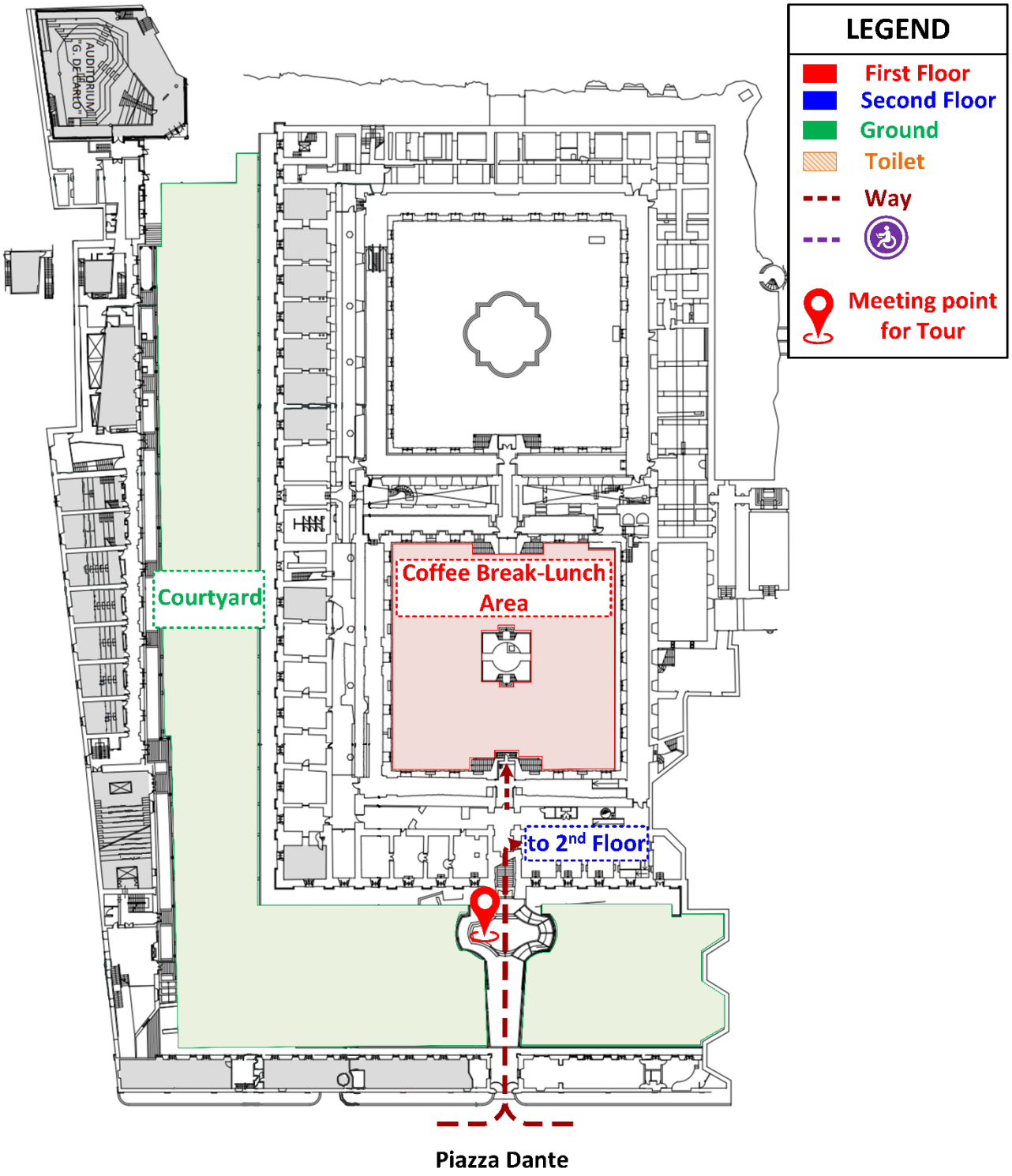
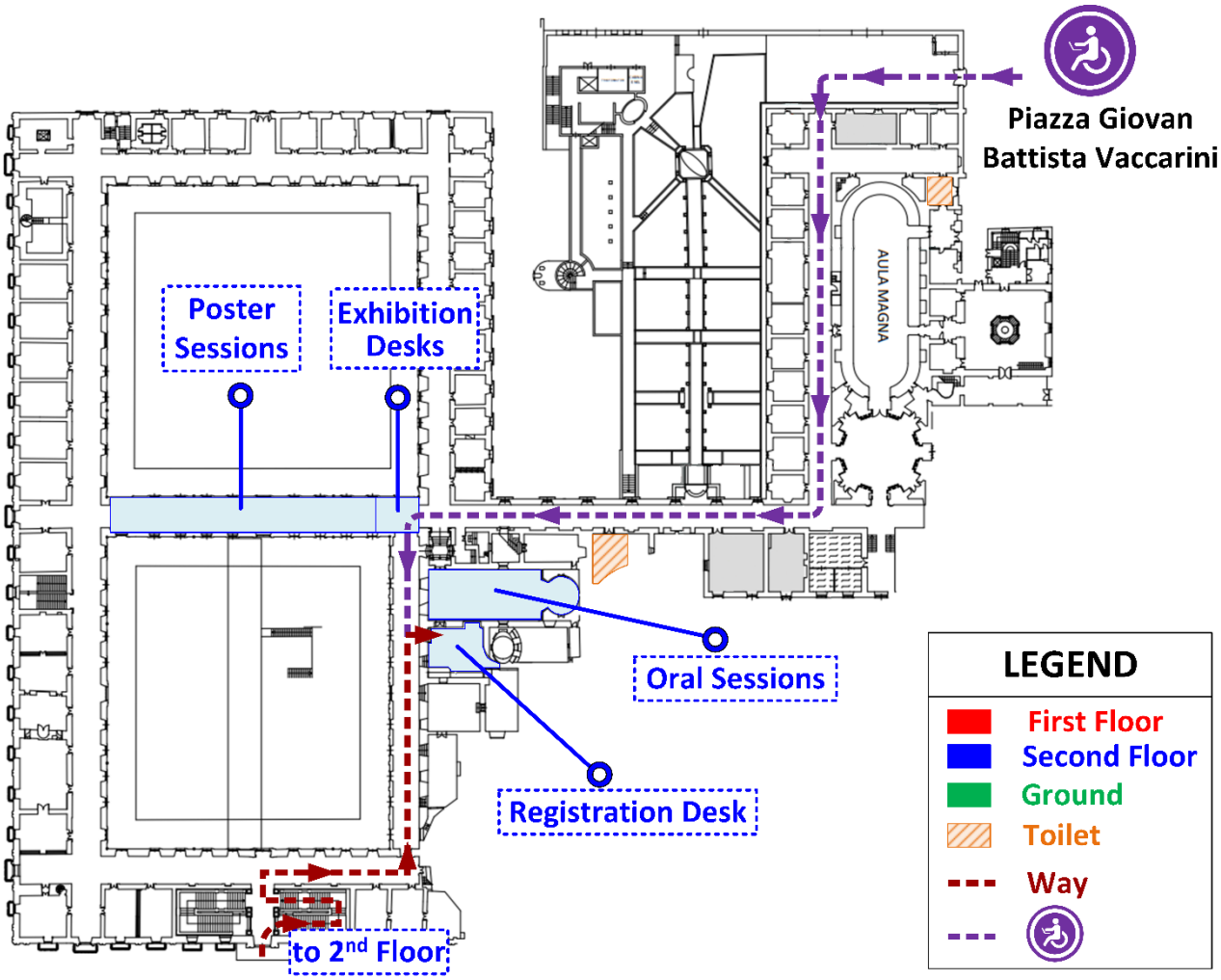
Benedectine Monastery Floor Plans

First Floor Map



Second Floor Map



MDPI Special Issue of Electronics

We invite authors to consider submitting extended versions of their abstracts to the MDPI Special Issue of Electronics, titled "GaN Technology's Role in Next-Generation Electronic Circuits and Power Applications."

Special Issue

GaN Technology's Role in Next Generation Electronics Circuits and Power Applications

Message from the Guest Editors

This Special Issue will include (but is not limited to) the following topics:

- GaN-based materials and heterostructures growth and characterization;
- Device processing steps (contacts, dielectrics, etching, etc.);
- GaN-based devices (advanced lateral HEMTs for power and RF applications, vertical GaN-based devices and packaging, etc.);
- Devices characterization, modeling and reliability;
- GaN systems: modeling, testing and reliability;
- Intelligent and integrated GaN solutions (systems in package and monolithic formats);
- Advanced topologies and control strategies for GaN-based power converters.

A selection of the best contributions will be invited to present the work at the "International Workshop of the EU Project GaN4AP" that the University of Catania is organizing in February 2025 in Catania. The workshop will be a unique opportunity for bringing together leading specialists working in different areas of gallium nitride (GaN) technology, both from universities, research centers and industries.

Guest Editors

Dr. Egidio Ragonese

Prof. Dr. Gianluca Giustolisi

Prof. Dr. Giacomo Scelba

Deadline for manuscript submissions

17 June 2025

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