

D4.2 4th year training report

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1. HISTORY OF CHANGES

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1.			

2. ABSTRACT

DiTArtIS Work Package 4 (WP4) is devoted to training activities aimed at improving the technical, scientific, digital and complementary skills of the research and support staff of the consortium. According to the Description of Action, WP4 includes consortium-level training events, training courses, short-term visits for research management and administration staff, and expert visits. WP4 was originally planned from **month 6 to month 23**, and Deliverable **D4.2 – Second year training report** was foreseen as the second report on these activities.

The DiTArtIS project started on **1 October 2022** with an initial duration of **36 months**, but it was later extended by **six additional months**, so that the project implementation now ends on **31 March 2026**. Therefore, this updated version of D4.2 is presented in the framework of the extended project duration and consolidates the WP4 activities relevant to the second reporting stage, while also reflecting the final implementation timeline.

This report includes:

1. the documentation and summary of **Training Events 3 and 4** under **T4.1**,
2. the structured overview of **training courses** attended by research management, administration and technical staff under **T4.2**,
3. the summary of **short-term visits** under **T4.3**, and
4. the summary of **expert visits** under **T4.4**.

The activities reported here contributed to knowledge transfer, enhancement of digital and technical skills, reinforcement of international collaboration, and strengthening of the research and innovation capacity of the consortium.

3. ACTIVITIES CARRIED OUT DURING THE REPORTING PERIOD

T4.1 – Consortium-level events organisation

According to the Description of Action, WP4 included the organisation of four consortium-level events. Events 1 and 2 were already covered in the first training report. Therefore, the present deliverable focuses on **Training Events 3 and 4**, as requested for finalisation of D4.2. Each event report is supported by the corresponding agenda, participant information where available, and photographic evidence or screenshots.

Training Event 3

The third training event was hosted by the University of Vaasa (Finland) on 20–22 May, under the leadership of the University of Vaasa (UV) and with support from TU/e and SISW. The event was delivered in a hybrid format, enabling participation both onsite and online. It was also integrated into the AIE Workshop. The full AIE programme, including the dedicated DiTArtIS sessions, is provided below:

3rd Training Event of DiTArtIS Project Combined with Sessions of AIE Workshop Program		
Monday 20.5 Nissi auditorium, Ankkuri building		
9.00	Start and coffee	AIE workshop (on-site)
9.30	Welcome speech (Marcelo Godoy Simões, Raine Hermans) & presenting the schedule.	
10.00-11.00	Keynote speech #1: Prof. Qihua Huang, Colorado School of Mines – Convergence of AI, Physics, Computing, and Control for Energy Transformation	DiTArtIS (Hybrid)
Session-1: AI/ML for Smart Energy Systems Chair: Enio Costa Resende		
11.00-11.20	Comparison between Symmetrical Short Circuit Current Contribution of Droop-Based Grid Forming Converter and Synchronous Generator	AIE workshop (on-site)
11.20-11.40	Fundamental Assessment of Oscillatory Performance of Grid-Forming Integrated Systems	
11.40-12.00	A Novel Approach to Prediction of the Transient Recovery Voltages in Shunt Reactor Circuit-Breakers and Determination of Hazardous Operation in High-Voltage Transmission Systems	
12.00-12.20	Analyzing the Performance of AC Microgrids in Stand-Alone Operation with Artificial Neural Network Controllers	
12.20	Lunch at restaurant August	
13.20-14.20	Keynote speech #2: Prof. Kevin Tansey, University of Leicester – AI and EO for Sustainability Monitoring	DiTArtIS (Hybrid)
Session-2: AI/ML for Sustainable Energy and Power Systems Chair: Enio Costa Resende		
14.20-14.40	Virtualized Intelligent Relaying of Smart Grid Over 5G Network	AIE workshop (on-site)
14.40-15.00	Inverter Dynamic Response Simulation via Neural Ordinary Differential Equations	
15.00-15.20	Advancing Sustainable Maritime with AI/ML Enhanced Hardware-in-the-Loop Testing	
15.20-16.20	Coffee break at Oscar & Poster Session in Lobby	
16.20-16.40	Your Very Own Polar Bear: Drawing Attention to Household Energy Efficiency Through Gamification	
16.40-17.00	Digital Technologies and AI Solutions for Electrification and Automation Off-Road Mobile Machinery Applications, Prof. Tatiana Minav, Tampere University	DiTArtIS (Hybrid)
17.00	End of Day	AIE workshop (on-site)
19.00	Cocktail event at Maaherrantalo (Koulukatu 2), sponsored by city of Vaasa	

Tuesday 21.5 Nissi auditorium, Ankkuri building		
9.00	Start and coffee & posters in lobby	AIE workshop (on-site)
9.30-10:30	Keynote speech #3: Prof. Peter Palensky, TU Delft – Power Grid Resilience via Deep Learning Methods	DITARTIS (Hybrid)
Session-3: Secure & Intelligent, Control & Monitoring of Smart Energy Systems Chair: Muhammad Faheem		
10.30-10.50	Start and coffee & posters in lobby	AIE workshop (on-site)
10.50-11.10	A Normal Behavior Model Based on Machine Learning for Wind Turbine Cyber-Attack Detection	
11.10-11.30	Towards a Model for Assessing the Effects of Social-Cyber-Physical Threats on the Future Power Grid – Review and Workshop Results	
11.30-11.50	Data-Driven Intermittent Earth Fault Detection Compensated and Isolated MV Networks	
11.50-12.20	Predictive Analysis of Transformer Faults Through Vibration Signatures and One-Dimensional Convolutional Neural Networks	
12.20	Lunch at August	
13.00-13.20	Industry presentation by WAPICE Ltd.	
13.20-13.40	Common Challenges and Solutions of AI Across Industries, Prof. Calina Ciuhu, Eindhoven University of Technology	DITARTIS (Hybrid)
13.40-14.30	Tutorial - Introduction to Julia (Luca Ferranti, Fabricio Oliveira)	AIE workshop (on-site)
14.30-15.30	Tutorial - Machine learning with Flux (Luca Ferranti, Fabricio Oliveira)	
15.30-16.15	Coffee break at Oscar & Poster session in Lobby	
16.15-17.15	Tutorial - Scientific Machine Learning in Julia (Luca Ferranti, Fabricio Oliveira)	
17.15-18.00	Tutorial - Optimization in Julia with JuMP (Luca Ferranti, Fabricio Oliveira)	
18.00	End of Day	
19.00	Dinner at Strampen (Rantakatu 7, Vaasa)	

Wednesday 22.5 Nissi auditorium, Ankkuri building		
9.00	Start and coffee & posters in lobby	AIE workshop (on-site)
9.30	Keynote speech #4: Prof. Moustafa Youssef, American University in Cairo - Sensor-less Energy-free Sensing: The Future of Ubiquitous Context-Awareness for the IoT	
Session-4: AI/ML Based Forecasting Techniques for Smart Power Systems Chair: Amit K. Shukla		
10.30-10.50	Model Order Reduction for Waste Heat Recovery: An Integrated Autoencoder-LSTM Neural Network Approach	AIE workshop (on-site)
10.50-11.10	Quantifying and Predicting Residential Building Flexibility Using Machine Learning Methods	
11.10-11.30	Anticipating Solar Photovoltaic Panel Output One Day in Advance with Gaussian Mixture Model	
11.30-11.50	Performance Evaluation of Sequence Model Architectures for Load Forecasting: A Comparative Study	
11.50-12.10	Rotodynamics Multi Fault Diagnosis Through Time Domain Parameter Analysis with MLP - A Comprehensive Study	
12.10-12.30	Closing speeches	
12.30	Lunch at restaurant August	

As the training event was embedded within an international conference, no dedicated DiTArtIS attendee list was available. Nevertheless, a selection of photographs from multilateral meetings and industry demonstrations held within the DiTArtIS framework is provided below:





The presentations delivered during the dedicated DiTArtIS sessions are available on the project platform. These materials provide an overview of the topics addressed, the methodologies discussed, and the key insights shared throughout the sessions, ensuring that all partners and stakeholders can access and revisit the content as needed.

Training Event 4

The fourth training event was hosted by the Universitat Politècnica de València (Spain) on 16–17 January 2025, under the leadership of UPV and with the support of UTC. The event was delivered in a hybrid format, enabling participation both onsite and online. The first day was dedicated to advanced tools for condition monitoring and fault diagnosis of electromechanical devices, while the second day was devoted to entrepreneurship and industrial marketing. The program of the training event is presented below:

4th Training Event of DiTArtIS Project – Universitat Politècnica de València (UPV)		
Thursday 16 th January		
8:30 – 9:00	Reception & accommodation	Sala Alfa (Building 5F)
9:00 – 11:00	Diagnosis and Prognosis of Electromechanical System Failures. Fundamental Principles and Advanced Methodologies with Case Studies – Mohamed Benbouzid (University of Brest)	Sala Alfa (Building 5F)
11:00 – 11:30	Coffee break & Networking	Building 5F Foyer
11:30 – 13:00	Beyond the Black Box: xAI and Transfer Learning for Smarter Bearing Fault Diagnosis – Jose E. Ruiz-Sarrió (UPV), Alexandra Baicoianu, and Arpad Kerestely (Siemens Industry Software)	Sala Alfa (Building 5F)
13:00 – 15:00	Lunch break in La Vella	Building 1B
15:00 – 16:00	Effective monitoring of HVDC insulation of cables and gas-insulated systems – Armando Rodrigo Mor (UPV)	Sala Alfa (Building 5F)
16:00 – 17:00	HIL demonstration: e-Drive with Non-Linear PMSM Controlled by External ECU– Typhoon HIL	Sala Alfa (Building 5F)
18:30 – 20:30	Social activity - Valencia city center on foot	Torres de Serrano
20:30 – 22:30	Dinner in Atenea Sky & Rooftop	C/Moratin, 12

Friday 17 th January		
8:30 – 9:00	Reception & accommodation	Salón de Actos (Building 5F)
9:00 – 9:30	Welcome from Vice-rector – Alberto Conejero Casares (UPV)	Salón de Actos (Building 5F)
9:30 – 11:00	Entrepreneurial Pathways: From Vision to High-Tech Success – Alexandru Lazarec (UTCN)	Salón de Actos (Building 5F)
11:00 – 11:30	Coffee break & Networking	Building 5F Foyer
11:30 – 13:30	Smart Start: Entrepreneurship in action – Veronica Maier (UTCN)	Salón de Actos (Building 5F)
13:30 – 15:30	Lunch break in La Vella	Building 1B
15:30 – 17:00	Knowledge Transfer in Food Industry Biotechnology - Marta Tortajada Serra (UCH-CEU)	Salón de Actos (Building 5F)
17:00 – 17:30	Closing speeches	Salón de Actos (Building 5F)

The list of registered attendees within the Ditartis project is provided in Table 5. Eighteen (18) people attended the event in-person, including partners from Siemens Software Romania (SISW), Technical University of Cluj-Napoca (UTCN), Eindhoven University of Technology (TU/e), University of Vaasa (UVA), and Universitat Politècnica de València (UPV). In addition

to the attendees on the list, other participants were joined online but were not registered in the event.

ID	FIRST NAME	LAST NAME	From	Attendance:
1	Bogdan	Butnariu	UTCN	In person
2	Vicente	Biot Monterde	UPV	In person
3	Raymond	Birasa	UTCN	In person
4	Veronica	Maier	UTCN	In person
5	Cristina	Adascalitei	UTCN	In person
6	Qudrat	Ullah	UTCN	In person
7	Hossein	Naderian	UVA	In person
8	Mojtaba	Mohammadikarachi	UVA	In person
9	Angela	Navarro Navarro	UPV	In person
10	Claudia	Martis	UTCN	In person
11	Geovanni	Diaz Saldaña	UTCN	In person
12	Nailia	Nasibulina	TU/E	In person
13	Mazaher	Karimi	UVA	In person
14	Jose Alfonso	Antonino Daviu	UPV	In person
15	Alexandra	Baicoianu	SISW	In person
16	Arpad	Kerestely	SISW	In person
17	Adrian Augustin	Pop	UTCN	In person
18	Oprea	Claudiu	UTCN	In person
19	Doha Kamal Mohamed	Idris	UTCN	In person
20	Tudor-Sebastian	Cornea	UTCN	In person
21	Caio	Osorio	THIL	In person
22	Jose Enrique.	Ruiz-Sarrio	UPV	In person
23	Anca	Nicu	UTCN	In person
24	Mohamed	Benbouzid	University of Brest	Online
25	Armando	Rodrigo Mor	UPV	In person
26	Alberto	Conejero Casares	UPV	In person
27	Alexandru	Lazarec	UTCN	Online
28	Marta	Toratajada Serra	Universidad Cardenal Herrera CEU	In person

The presentations are available on the project website, providing open access to selected materials for partners and stakeholders.

The available list contains **28 registered participants**, combining in-person and online attendance, with representation from **UTCN, UPV, UVA, SISW, TU/e, THIL**, and external institutions such as the **University of Brest** and **Universidad Cardenal Herrera CEU**.

The documentation available for this event includes:

- the event agenda,
- the registered participant list,
- the lecturers' presentations in PDF format,
- and photos/screenshots from the event.

Together, Training Events 3 and 4 completed the consortium-level training programme foreseen under WP4 and provided specialised content closely aligned with the project's objectives in digital technologies and AI solutions for electromechanical and power systems applications.

T4.2 – Training courses

Several structured training courses were attended by consortium members during the project implementation. These activities covered technical, digital, leadership, teaching, and research-management competences, and therefore contributed directly to the objectives of WP4.

Training courses attended by UTC staff

- **Advanced e-Motor Design with JMAG**, hosted by Powersys, on **22.10.2024**, attended by **Cristina Adascalitei, B. Butnariu and R. Birasa**. The course content focused on an overview of **JMAG modelling and simulation tools**.
- **Horizon Europe Academy**, hosted by **Europa Media Trainings**, attended by **Cristina Adascalitei**, on **16–20 October 2023**.
- **Horizon Europe Academy**, hosted by **Europa Media Trainings**, attended by **Ioana Simona Muresan** on **18–22 March 2024**.
- **Lump sum proposals and projects in Horizon Europe**, hosted by **Europa Media Trainings**, attended by **Ioana Simona Muresan** on **5 February 2024**.
- **European project management course**, hosted by **Europa Media Trainings**, attended by **Crina Ianchis** on **20-24 February 2024**.
- **PM² Project Management Methodology for European Funded Projects**, hosted by **Europa Media Trainings**, attended by **Cristina Adascalitei** on **16-17 March 2026**.

Training courses attended by SISW staff

The collected information reports the following courses attended by SISW staff:

- **5AT010: Electrical Components**, attended by **Robert Matei Szabo and Flavius Paduraru**, from **15/11/2024 to 5/01/2025**.
- **5LWF0: FEM for electromagnetic devices**, attended by **Robert Matei Szabo and Flavius Paduraru**, from **12/02/2025 to 4/04/2025**.
- **Fundamentals of AI for Simulation Engineers**, attended by **Calin Husar**, organised by **NAMFEMS**, on **8–9 April 2025**.
- **EMR Summer School 2023**, attended by **Alexandra Baicoianu and Calin Husar**, on **12–16 June 2023**.
- **EMR Summer School 2025**, attended by **Calin Husar and Robert-Matei Szabo**, on **8–11 July 2025**.
- **Superior Leadership**, attended by **Alexandra Baicoianu and Calin Husar**, in **summer 2025**.
- **Cloud Computing**, attended by **Calin Husar, Alexandra Baicoianu, Tiberio Brinzea, Robert Szabo and Viorica Puscas**, in **summer 2025**.

Training courses attended by Tajfun HIL staff

The collected report indicates that **Dusanka Sudar** participated in the **Electrical Components** course organised by project partner **TU/e**.

Additional structured course content documented in the report

The training-courses document contains a detailed narrative description of the **FEM for Electromagnetic Devices (5LWF0)** course, explaining that it provided theoretical and practical competences in:

- weak formulation and boundary conditions,

- discretisation and basis functions,
- FLUX2D-based modelling,
- solver selection,
- electromagnetic field visualisation,
- inductive components and machine modelling,
- losses, torque, thermal analysis and demagnetisation checks.

The same document also contains a detailed description of the **Electrical Components (5AT010)** course, focusing on hybrid and electric vehicles, traction electrical machines, power electronics, batteries, charging systems, and multi-physical interactions at powertrain level.

Overall, the set of training courses reported under T4.2 demonstrates that WP4 did not only rely on consortium-level events, but also on specialised external courses and staff upskilling activities that reinforced the technical and administrative capacities of consortium members.

Training courses attended by UPV staff

The collected report indicates that **Jose E. Ruiz-Sarrio** participated in the following courses and seminars:

- II workshop in digitalization of industrial maintenance,
- Course: Writing of learning objectives,
- Course: Verbal and Nonverbal Communication Skills for Educators,
- Course: Introduction Training for Newly Appointed Tutor Faculty,

In synthesis, the list of training courses is included in the following table:

TRAINING COURSES				
Mobility of experts and organisation of structured training courses to strengthen technical capacity, transfer knowledge, and support implementation of project activities.				
<i>Participants</i>	<i>Training/course title</i>	<i>Host Institution</i>	<i>Dates</i>	<i>Training/course content</i>
<i>UTC</i>				
Cristina Adascalitei; B. Butnariu; R. Birasa	Advanced e-Motor Design with JMAG	Powersys	22.10.2024	Overview of JMAG modelling and simulation tools
Cristina Adascalitei	Horizon Europe Academy	Europa Media Trainings	16-20 October 2023	Overview of how to write a proposal and how to do project management in European funded projects, explanation of personnel cost-related financial rules and

				<i>reporting protocols in Horizon Europe.</i>
Ioana Simona Muresan	Horizon Europe Academy	Europa Media Trainings	18-22 March 2024	<i>Overview of how to write a proposal and how to do project management in European funded projects, explanation of personnel cost-related financial rules and reporting protocols in Horizon Europe.</i>
Ioana Simona Muresan	Lump sum proposals and projects in Horizon Europe	Europa Media Trainings	5 february 2024	<i>Overview of writing and managing a lump sum proposal.</i>
Crina Ianchis		Europa Media Trainings	20-24 February 2024	<i>Financial rules: direct personnel costs and workshop on personnel cost calculation</i>
Cristina Adascalitei;	PM ² Project Management Methodology for European Funded Projects	European Academy	16-17 March 2026	<i>PM² is the standard project management methodology of the European Commission and the most widely preferred approach for managing EU-funded projects. This course provided an in-depth explanation of this methodology and how to apply it on projects.</i>
SISW				
<ul style="list-style-type: none"> • Robert Matei Szabo & Flavius Paduraru: 5AT010: Electrical Components 15/11/2024 - 5/01/2025 • Robert Matei Szabo & Flavius Paduraru: 5LWF0: FEM for electromagnetic devices 12/02/2025 - 4/04/2025 • Calin Husar: Fundamentals of AI for Simulation Engineers, 8 – 9 April 2025, NAMFEMS • Alexandra Baicoianu & Calin Husar : EMR Summer School 2023, 12-16 June 2023 • Calin Husar & Robert-Matei Szabo : EMR Summer School 2025, 8-11 July 2025 • Alexandra Baicoianu & Calin Husar : Summer 2025, Superior Leadership • Calin Husar, Alexandra Baicoianu, Tiberio Brinzea, Robert Szabo, Viorica Puscas, summer 2025 – Cloud Computing 				
Tajfun HIL				
Dusanka Sudar participated Electrical Components course which is organized by project partner TU/e.				
UPV				
The team at UPV actively contributed to strengthening teaching quality and professional development through a series of targeted training initiatives and knowledge-sharing activities.				
<ul style="list-style-type: none"> • II workshop in digitalization of industrial maintenance – Jose E. Ruiz-Sarrio 				

- Writing of learning objectives – Jose E. Ruiz-Sarrio
- Verbal and Nonverbal Communication Skills for Educators – Jose E. Ruiz-Sarrio
- Induction Training for Newly Appointed Tutor Faculty – Jose E. Ruiz-Sarrio

TU/e – part of WP2 twinning activities

TU/e offered a course **FEM for electromagnetic devices (5LWF0)** to three students: Robert Szabo, Flavius Paduraru, and Paula Petrescu, from Siemens Industry Software and Technical University of Cluj Napoca.

The course FEM for Electromagnetic Devices provided students with a solid foundation in both the theoretical principles and the practical application of the finite element method for electromagnetic analysis. Throughout its duration, students developed an understanding of how electromagnetic boundary value problems are formulated mathematically using the weak formulation. This included recognizing the role of domain discretization, the criteria for selecting basis functions, and the influence of domain truncation on numerical accuracy. Students also learned to distinguish between essential and natural boundary conditions and how these conditions shape the structure of an FEM model.

Alongside theory, the course placed strong emphasis on practical modelling skills using the FLUX2D software environment. Students learned to construct parameterized and simplified two-dimensional geometries suited to inductive components and electrical machines. They developed the ability to evaluate and improve mesh quality and to correctly assign physical regions such as materials, conductors, and boundaries. An important achievement was learning how to choose the appropriate solver type—magnetostatic, steady-state AC, or transient—depending on the physical characteristics of the system being studied.

A central part of the course involved the visualization and interpretation of electromagnetic field quantities. Students practiced displaying magnetic vector potential, magnetic flux density, magnetic field strength, and current density, as well as evaluating material properties such as permeability, conductivity, and remanence. From their models, they learned to extract global electromagnetic quantities including flux linkage, losses, and induced electromotive force. These skills enabled students to analyze the behavior of inductive components under realistic operating conditions.

A major theme was understanding how different geometrical and material parameters influence device behavior. Students investigated the impact of magnetic saturation in nonlinear materials, differentiating between apparent and incremental inductances in pre-biased devices. They analyzed the role of eddy currents in solid conductors and explored methods for dealing with losses in laminated magnetic cores. This allowed them to see how design decisions directly affect performance in practical components.

The course then extended these principles to electric machines. Using FLUX2D, students learned to compute key machine characteristics such as flux-linkage versus magnetomotive force maps, torque constants, EMF constants, and per-phase synchronous impedance. They gained insight into determining suitable commutation angles and calculating feasible winding configurations for machines with different electrical connections, speeds, and drive requirements. A deeper understanding was also developed regarding the origin of torque ripple and the engineering measures available to minimize it.

Realistic design work requires validation beyond electromagnetic fields alone, and students learned to perform physical feasibility checks on their models. This included performing thermal analyses within FLUX2D to evaluate temperature rise and operational limits, and carrying out demagnetization checks for permanent-magnet machines operating under fault or overload conditions. Through these exercises, students learned how electromagnetic, thermal, and material considerations must be integrated during design.

The course content blended the theory of electromagnetic FEM with hands-on software work, covering static and transient simulations, circuit coupling, nonlinear material behavior, harmonics, torque production, cogging effects, losses in permanent magnets, and thermal simulations. A recurring theme was comparing idealized textbook machine models with more realistic nonlinear FEM results and optimizing machine designs accordingly.

The students' understanding and learning progress were evaluated through an oral examination and a written report, both of which needed to be passed to successfully complete the course. Throughout the course, Cedrat FLUX2D served as the primary software tool, supported by the reference book *Design of Brushless Permanent-Magnet Machines* by Hendershot and Miller.

In conclusion, the course equipped students with the theoretical insight and the practical simulation skills needed to analyze electromagnetic devices using finite element methods. By the end, they were able to construct accurate FEM models, interpret field results, assess realistic machine behavior, and validate their designs through both electromagnetic and thermal considerations. This provides a strong foundation for further work in the fields of electrical machine design, power electronics, and electromagnetic system optimization.

Next, TU/e offered a course **Electrical components (5AT010)** to four students: Dusanka Sudar, Robert Szabo, Flavius Paduraru, Raymond Birasa from Typhoon HIL, Siemens Industry Software, and Technical University of Cluj Napoca.

The course Electrical Components introduced students to the fundamental technologies that shape modern Hybrid Electric Vehicles (HEVs) and fully Electric Vehicles (EVs). The focus spanned across passenger cars and commercial vehicles, allowing students to understand how electrical powertrains are engineered, integrated, and controlled within different mobility segments. The course provided a cohesive view of the main components—traction machines, power electronics, batteries, charging systems, and fuel cells—while highlighting how these subsystems interact within a complete vehicle powertrain.

Throughout the course, students developed the ability to identify the working principles of key electrical components from the perspective of a systems engineer. This required not only understanding individual components, but also how they behave when integrated within an (H)EV powertrain. Students learned the operating principles of traction electrical machines, including how torque and power are controlled and delivered to the wheels. They also gained insight into power electronic converters, which form the interface between energy sources and electric machines, enabling efficient conversion and modulation of electrical energy. Equally central were batteries and energy storage systems, where students explored topics such as state-of-charge estimation, battery degradation mechanisms, and the challenges associated with fast-charging.

A large part of the course focused on understanding both current and emerging vehicle technologies. Students learned about the evolution of electrification in the automotive sector, from hybrid configurations to fully electric and fuel-cell electric vehicles. The course highlighted how industry trends influence component

design and how advances in materials, control strategies, and semiconductor devices are shaping next-generation powertrains. With this, students were introduced to the basic concepts behind component-level control, including how powertrain controllers manage energy flow, torque requests, charging operations, and interactions with other vehicle subsystems.

A key learning objective was the development of insight into the multi-physical interactions between electrical, mechanical, thermal, and electrochemical domains. Students explored how these interactions determine the performance of the overall powertrain. For example, they examined how inverter switching behavior affects machine losses and thermal performance, how battery temperature influences power delivery capability, and how mechanical load cycles impact electrical system sizing. These relationships formed the basis for understanding how components must be integrated into a balanced and functional vehicle-level system.

The course emphasized practical engineering skills by enabling students to perform first-order design estimations of electrical components and to evaluate vehicle performance using MATLAB and Simulink. Through assignments, students modeled powertrain behavior, simulated energy flows, and analyzed how component choices affect acceleration capability, efficiency, and driving range. These exercises supported the development of system-level thinking, allowing students to evaluate trade-offs and understand how design decisions propagate through the powertrain architecture.

The topics covered by the lecturers provided a coherent structure for the course. Students began with an introduction to powertrains and simulation techniques, establishing a foundation for subsequent content. The lectures on electrical machines offered an in-depth exploration of electromagnetic torque production, machine topologies, efficiency considerations, and control principles. This transitioned naturally into power electronics and charging, where students studied converters, inverters, on-board chargers, and the interface between vehicles and charging infrastructure. The sections on batteries and energy storage provided essential electrochemical background and system-level considerations such as thermal behavior, degradation, and battery management strategies. Powertrain control lectures tied the components together by showing how control algorithms coordinate the vehicle's operation, while the sessions on fuel cells extended the course beyond battery-electric technology into alternative zero-emission propulsion systems.

Assessment in the course was based on assignments that required the application of MATLAB/Simulink scripts. These assignments were designed to simulate real engineering tasks, such as evaluating electrical machine performance, estimating vehicle energy consumption, and modeling component behavior under different driving conditions. Through these activities, students gradually developed the ability to translate theoretical knowledge into practical computational models.

In conclusion, the course provided students with a strong conceptual and practical foundation in the electrical components that enable hybrid and electric vehicles. By the end of the course, students were able to understand how major components operate, describe current and emerging propulsion technologies, interpret interactions between powertrain subsystems, and perform introductory design and simulation tasks using industry-relevant tools. This knowledge prepares students for further work in automotive electrification, powertrain engineering, and mobility-related research.

UVA

No declared attended trainings

T4.3 – Short-term visits

According to the Description of Action, short-term visits under WP4 were intended especially for the research management and administration staff, in order to strengthen competences related to Horizon Europe proposals, project implementation and reporting. In practice, the material compiled for this deliverable also includes broader short-term mobility activities linked to training, mentoring and inter-partner knowledge exchange.

The summary below consolidates the information currently available in the short-term visits document.

Reported short-term visits

- **23–27 April 2023:**
3 researchers from TU/e (E. Lomonova, E. Ilhan Caarls, G.H. Bayazit), **1 from UVA** (M. Shafiekhah), **1 from UPV** (J.E. Ruiz Sarrio), and **5 from SISW** (K. Arpad, C. Irimia, A. Baicoianu, R. Bocu, D. Sasu) visited the laboratories of UTC and attended the first training event sessions.
- **11–15 June 2023:**
5 researchers (C. Martis, A. Constantinescu Dobra, I. Gros, C. Oprea, S. Salcu) visited UVA. The same document also indicates that **Sorin Cosman (UTC)** visited SISW for **8 days**.
- **July 2023 – September 2023:**
Jonathan Cureño Osornio and **Alvaro Ivan Alvarado**, from **Querétaro (Mexico)**, visited UPV for **mentoring activities**.
- **3-7 November 2024:**
Sorin Cosman and **Claudiu Oprea** visited UPV. The visit included some joint research discussions and visit of UPV facilities.
- **18–24 February 2024:**
Vahid Shahbazbegian and **Seyed Mahoor Ebrahimi** from UVA visited SISW. The agenda included discussion of RS2 activities, AI/ML topics for power and energy, case studies on AI/ML models, introduction to **Simcenter Amesim** with hands-on activities, electromagnetics for electrical engines, and presentation of SISW research projects.
- **September 2024 – December 2024:**
Geovanni Diaz Saldaña, from **Universidad Autónoma de Querétaro (Mexico)**, visited UPV for **mentoring activities**.
- **September 2025:**
Israel Zamudio Ramirez, from **Universidad Autónoma de Querétaro (Mexico)**, visited UPV for **mentoring/training activities**.
- **December 2025 – March 2026:**
Carlos A. Alvarez-Ugalde, from **Universidad Autónoma de Querétaro (Mexico)**, visited UPV for **mentoring activities**.

- **January 2026 – March 2026:**
Jonathan Cureño Osornio, from **Universidad Autónoma de Querétaro (Mexico)**, visited UPV for **mentoring activities**.
- **24–26 September 2025:**
Dr. Caio Osorio and **Tomislav Magazin** from **Tajfun HIL** visited UTCN with the aim of presenting THIL capabilities and knowledge sharing.
- **24-26 March 2026:**
A. Baicoianu, C. Husar, A. Kerestely, R. Szabo, T. Brinzea and V. Puscas visited UPV with the aim of stablishing future collaboration and visiting UPV facilities including and industrial visit and a series of exchange seminars.

Summary

The short-term visits supported inter-institutional collaboration, mentoring, technical exchange, and exposure to advanced research infrastructures and software tools. In addition, the project extension until **31 March 2026** enabled further mobility and mentoring activities to continue during the final six months of implementation.

T4.4 – Expert visits

The Description of Action foresees **three to five expert visits**, to be defined according to the needs identified in the project and the additional training topics required by the consortium. The updated expert-visits file currently reports the following confirmed expert visits:

- **Expert:** J.E. Ruiz Sarrio
- **Sending institution:** UPV
- **Host institution:** UTC
- **Dates:** 6–23 April 2025
- **Purpose of visit:** Delivery of specialised courses
- **Activities delivered:** Lectures

- **Expert:** J.A. Antonino-Daviu
- **Sending institution:** UPV
- **Host institution:** UTC
- **Dates:** 24–26 September 2025
- **Purpose of visit:** Visit UTC facilities and knowledge exchange
- **Activities delivered:** Seminars

- **Expert:** Mazaher Karimi
- **Sending institution:** UVA
- **Host institution:** UTC
- **Dates:** 24–26 September 2025
- **Purpose of visit:** Visit UTC facilities and knowledge exchange
- **Activities delivered:** Seminars

- **Expert:** Elena Lomonova
- **Sending institution:** TUE
- **Host institution:** UTC
- **Dates:** 13 October 2025
- **Purpose of visit:** Visit UTC facilities and knowledge exchange. Named d.h.c. by UTC.
- **Activities delivered:** Seminars

These visits contributed to the strengthening of specialised knowledge transfer between consortium partners and is consistent with the expert-visit mechanism foreseen in WP4. The activity also complemented the broader training effort implemented through the consortium events and the specialised courses described above.

If additional expert visits were carried out, they are not yet visible in the current supporting file and should be added only if the corresponding nomination, scope of activities and supporting evidence are available.

4. DEVIATIONS FROM THE WORKPLAN

No major deviation has been identified regarding the scope of WP4 activities. The training framework defined in the Description of Action included consortium-level events, training courses, short-term visits and expert visits, and these four components are reflected in the present report.

However, two practical considerations should be made explicit:

1. **Project extension:** although the original DiTArtIS duration was **36 months**, the project was later extended to **42 months**, ending on **31 March 2026**. This affects the temporal framing of the present updated deliverable.