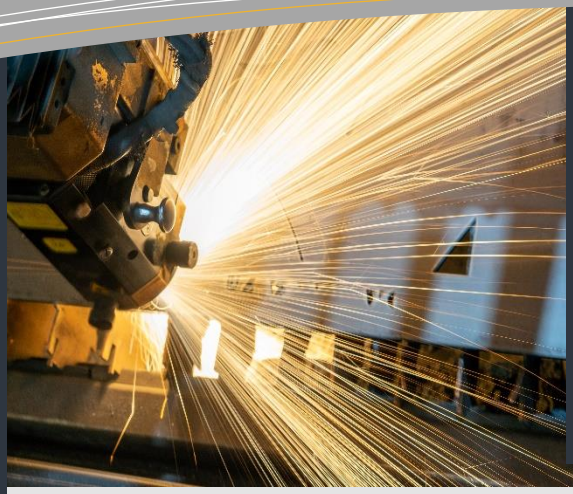
ISSUE
06
June 2023

JOURNAL OF
IMOCO4.E

iMOCO4.E



KEY FACTS

Acronym: IMOCO4.E
Full name: Intelligent Motion Control under Industry4.E
Coordinating institution: Sioux Technologies B.V.
Project coordinator: Arend-Jan Beltman
GA No.: 101007311 - H2020-ECSEL-2020-2-RIA
Start date: 1st September 2021
Duration: 36 months
Consortium: 46 Partners from 13 countries

This issue provides a grasp of the main project developments during *February 2023 – April 2023*. It also provides facts on the results achieved, as well as links to the latest dissemination activities.

IMOCO4.E Highlights

During the reference period, the consortium continued developing the IMOCO4.E concept and methodologies, with extremely promising results. These results were extensively presented at the 3rd Consortium Meeting in Bilbao, Spain on March 28 – 30th, 2023. Besides the presentation of actual achievements, IMOCO4.E partners discussed upcoming work, possibilities of Model Management, definition of execution of Pilot 3 – High speed packaging (T7.1), Verification, Validation and Integration Plan (T6.2, T6.3, T6.4 and T6.7), Digital Twinning (WP5, WP6), Building Blocks (BBs) and finally, brainstorm towards the prerecorded video preparations.

WHAT HAS BEEN DONE?

WP2

WP2 has officially ended in Jan 2023 and is only active for coordination between the other WPs, reporting and dissemination. The deliverable D2.1 was resubmitted considering the reviewers' feedback. WP2 presented the status updates and the final results to the IMOCO4.E consortium during the consortium meeting in Bilbao. In addition, WP2 plans to disseminate the IMOCO4.E framework results.

WP3

WP3 has completed one of its tasks, T3.1. The result is Deliverable D3.2, the final iteration of the Perception and Instrumentation Layer's requirements and specifications. The remaining tasks, T3.2-T3.5, are focused on their respective deliverables, demonstrators D3.3-D3.6. These deliverables include the BB3-connected "Novel low/self-powered real-time sensors", the BB1-connected "New SoC+FPGA and multi/many-core platforms for AI and smart data processing", the BB2 and BB8-connected "AI-based high-speed perception and vision", and the BB7-connected "High-Performance servo drives and variable-speed drives.

What has been done

WP4

WP4 is running at cruise speed for the development and validation of smart control algorithms and AI and vision compatible hardware. Task 4.1 has been successfully closed after the definition of the requirements of the three Building Block that are part of WP4: BB4, Real-Time Smart-Control Platform, BB5, Smart Control Algorithms, and BB10, Motion / path planning, collision avoidance and navigation algorithms. These requirements were properly gathered and reported in deliverable D4.2. Task 4.2 continues working in the definition of a common XiL methodology for control system design based in Digital Twins based in current approaches used by IMOCO4.E partners. SIEMENS presented a cloud-based MiL demonstration connecting simulation instances located in different countries. Partners involved in Tasks 4.3 and 4.4 are deeply working in the development and implementation of smart control algorithms, that will contribute to IMOCO4.E Building Block 5. While Task 4.3 is working in centralized (SISO) control strategies like Gaussian Process Repetitive Control, compensation systems to improve the performance of industrial robots, or robust input shapers for vibration avoidance, Task 4.4 is focused on the development of decentralized (MIMO) control approaches like Model predictive Control and machine learning based control, as well as data driven learning-based control approaches. Task 4.5, linked with IMOCO4.E Building Block 10, continues working on path planning, route optimization, and decision making (collision avoidance) of mobile robots. Last advances in IMOCO4.E Demonstrator 3, Warehouse logistics, consist on the application of Visual Model Predictive Control the dynamic pickup of load carriers in a warehouse. Finally, partners in Task 4.6 continue working in different multi-core edge platforms as well as required development framework that includes vision and Artificial Intelligence workload as well as TSN communication, that will be integrated through different IMOCO4.E Pilots, Demonstrators and Use cases. Partners involved in Tasks 4.3 to 4.5 are currently committed with the reporting of these activities in the corresponding deliverables for BB technological description, due to M21. In the same way, a great effort is being performed to organize a new workshop for the ETFA conference 2023, with several contributions from IMOCO4.E WP4.

WP5

In the first month of this period, the second iteration of requirements was provided in deliverable D5.2. In parallel, all the tasks were involved in the preparation of presentations for the consortia meeting in Bilbao. WP5 presentation was given per tasks by individual task leaders, and we saw their very interesting results and achievements. There were two workshops taking place in Bilbao which were related with WP5. One was about the model management and one, co-organized with WP6, was about digital twins. After this successful meeting, partners started to prepare five deliverables which are due in M21. At the moment no delay is foreseen, and the deliverables should be provided in time.

WP6

WP6 is passing through a critical project period with success, thanks to the enormous effort of all consortium partners. Following the W-approach, component clusters are now ready to cover the first iteration of all pilot, demo and use case implementations. The verification, validation and testing plan is being defined for each component and cluster. WP6 continues with supply chain risk monitoring and with methodology viewpoints sharing. Finally, four use cases are being developed within WP6 and their first version will soon be reported in the related deliverable.

WP7

WP7 is about the pilots and demonstrators. Monthly the status has been discussed in the WP7 meeting. Mainly the status of the SW and HW components and the relation to building blocks are determined to be important. Partners worked together within the pilots and demo's, for instance on VR simulation, model development, fault detection, data security and management

and sensor development. Discussed was what the content of the next deliverables will be. Each pilot and demo will make a video, poster or report towards the review meeting in November.

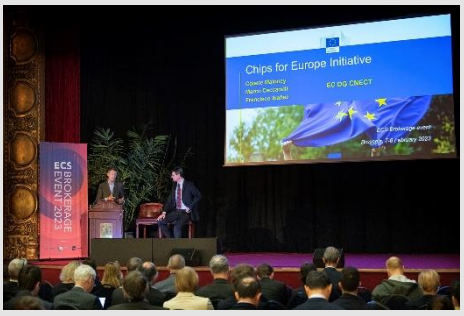
Dissemination & Communication

IMOCO4.E values the importance of networking, exchanging ideas and knowledge with other similar EU projects. The consortium has managed to generate discussions with H2020 TIBCO, METIS and MADEin4 aiming at the co-organization of special sessions as well as boosting joint dissemination activities.

Liaison activities are in progress

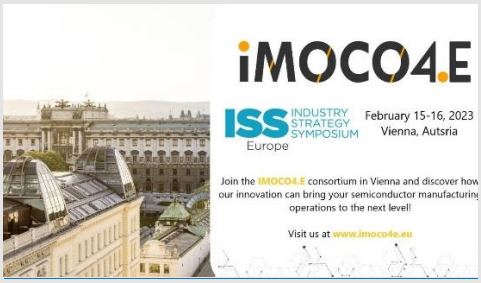
During the reference period, the partners intensively disseminated the project results by spreading knowledge and creating good networking opportunities with industrial and scientific peers. The IMOCO4.E partners have focused to widen up the network of scientific experts of the project and transferred valuable scientific results by participating in multiple online and physical conferences and workshops. Visibility of the project and transferability of the project outcomes has been promoted through the update of the promotional material and by regular dissemination to the public through social media channels.

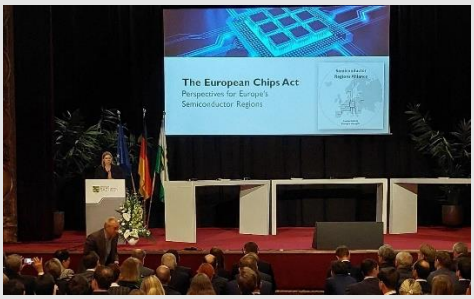
During the past 4 months and in the context of WP8 activities, IMOCO4.E participated in the several events, such as:



IMOCO4.E partners attended ECS Brokerage Event in Brussels, Belgium during February 7th – 8th 2023 in order to gather future technology directions.
(Representative partners: Sioux, Philips, Tyndall, UGR, Orolia, Nuro, EDI).
More details here

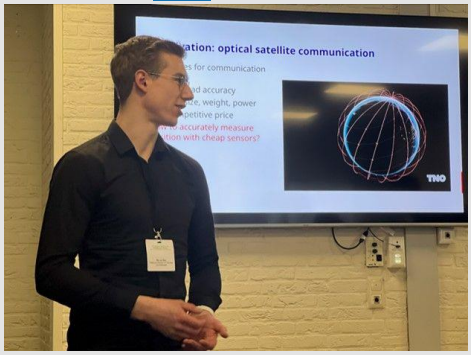
IMOCO4.E project attended ISS Europe 2023 in Vienna, Austria during February 15th-16th.
(Representative partner: SEMI).
More details here





IMOCO4.E project at "The European Chips Act - Perspectives for Europe's Semiconductor Regions" organised by the Free State of Saxony, Germany on 6th of March 2023.
(Representative partner: SEMI).
More details here

IMOCO4.E partner, TU/e, attended the Benelux Meeting on Systems and Control on 22nd of March in Elspeet, the Netherlands where presented its research.
(Representative partner: TU/e).
More details here



During 04-07 April 2023, IMOCO4.E project attended INTEK 2023, the premier Romanian trade show for smart manufacturing, industry 4.0 technologies, and sustainability, in Brașov, Romania.
(Representative partner: Siemens Industry Software Romania).
More details here

IMOCO4.E partner, Reden Research & Development Nederland, gave a short presentation during the Math4NL community event “Digital Twins” with title "Digital twin for remaining useful lifetime estimation of an electrical component".
(Representative partner: Reden Research & Development Nederland).
More details here

In addition, IMOCO4.E partners plan to participate in:

- SPAA, 17-19 Jun 2023, Orlando, Florida, USA – Event Link
- 22nd IFAC World Congress, 9-14 Jul 2023, Japan, Yokohama – Event Link
- Eurosensors 2023, 10-13 Sep 2023, Lecce, Italy – Event Link
- ETFA 2023, 12-15 Sep 2023, Sinaia, Romania – Event Link

Consortium/Review Meetings, Publications & Submitted Deliverables

Prerecorded videos

Coming Soon!!

Although the outreach activities continue with weekly posts on social media platforms (LinkedIn and Twitter), the IMOCO4.E team plans to increase knowledge and visibility of the project by raising awareness of the benefits of the IMOCO4.E platform on specific use cases and demonstrators via prerecorded videos!

46 IMOCO4.E partners met f2f at the 3rd Consortium Meeting in Bilbao, Spain on March 28 – 30th, 2023.

The meeting started with a guided tour at Tekniker's premises and then WP Leaders presented the progress, the status and the results of the projects' technical WPs. During the 2nd day presented the progress of the WP6 and the partners participated in #6 dedicated #Workshops to plan and prepare upcoming work and discuss about the Model Management, definition of execution of Pilot 3 – High speed packaging (T7.1), Verification, Validation and Integration Plan (T6.2, T6.3, T6.4 and T6.7), Digital Twinning (WP5, WP6), Building Blocks (BBs) and finally, brainstorm towards the prerecorded video preparations (WP8). The 3rd day, the progress, and short-term plans of overall project management and dissemination, communication, exploitation and standardization activities have been presented in detail.

Overall and during this three-day meeting, the IMOCO4.E partners had the opportunity to discuss the technical progress, to explore possible collaborations within the project and towards the BBs, pilot and use cases implementation and to present their short-term plans preparing the upcoming work and deliverables.

IMOCO4.E partners will meet again in the next Consortium Meeting in Eindhoven, Netherlands in November 2023.

IMOCO4.E Publications

The IMOCO4.E project also tries to have an active performance via conference paper publication by presenting the research work carried out in the frame of the project. The list of upcoming presented articles is shown below:

- "Polynomial Feedforward for Linear Parameter-Varying Systems: a Kernel Regularized Approach", 22nd IFAC World Congress, Yokohama, Japan, 2023
- "Cascaded Calibration of Mechatronic Systems via Bayesian Inference", 22nd IFAC World Congress, Yokohama, Japan, 2023

Submitted Deliverables

- D3.2 - "Perception and instrumentation Layer requirements and specifications (final iteration)"
- D4.2 – "Requirements for advanced motion control (final iteration)"
- D5.2 – "Integral (system level) requirements for valuable twinning methods (second iteration)"
- D1.5 – "Midterm Progress Report (M18)"

iMOCO4.E

ECSEL Joint Undertaking

The project has received funding from the Electronic Component Systems for European Leadership Joint Undertaking, under Grant Agreement n°101007311. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Netherlands, Czech Republic, Spain, Greece, Ireland, Belgium, Latvia, Portugal, Germany, Finland, Switzerland.