



DIMOFAC

OPEN PILOTS CATALOGUE OF SERVICES



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870092.

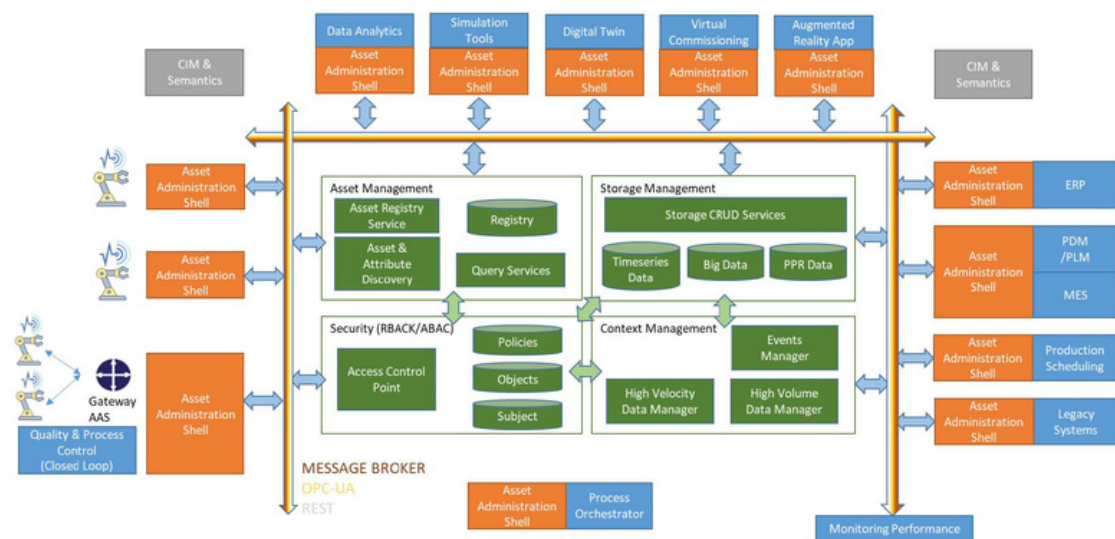
Introducing DIMOFAC

The Future of Manufacturing



DIMOFAC offers a modular and reconfigurable approach to manufacturing that adapts to different product specifications. Its seamless digital thread along the manufacturing chain allows for low-volume production schemes to be deployed with ease.

The DIMOFAC Modular Factory Solution incorporates PnP production modules, product and process modeling and simulation suites, closed-loop inline and real-time control, automatic reconfiguration tools based on mobile and collaborative robots, cognitive analytics tools, and resource planning allocation and reconfiguration tools. These technologies enable fast and robust manufacturing with advanced monitoring and control capabilities, leading to automated, zero-defect, flexible, rapid, and cost-effective production of high-added value products.



DIMOFAC is a digital platform designed for Industry 4.0 that utilises large-scale machine-to-machine communication and the internet of things to increase automation and improve communication.

DIMOFAC uses AAS to facilitate Industry 4.0 goals through a platform with three main components:

- **the AAS repository**
- **the AAS data manager**
- **the AAS central authentication system**

These enablers facilitate the integration and operation of the rest of DIMOFAC solutions, making it possible to tackle the customised demand of the future manufacturing industry.

OUR SERVICES

- AIMEN iM2AM: Service Package
- AIMEN LTMAP: Service Package
- CEA CIVA: Service Package
- CEA ARES: Service Package
- SMART FACTORYKL: Service Package
- IPC: Service Package
- TECNALIA: Service Package
- SWITZERLAND INNOVATION PARK:
Service Package
- BPT INDUSTRIES CAMPUS: Service Package
- LMS: Service Package
- INDUSTRY 4.0 LAB: Service Package

Intelligent Multi-material and Additive Manufacturing Pilot line



AIMEN IN A NUTSHELL

Founded: 1967

Location: O Porriño, Spain

Technology: Additive

Manufacturing by Direct Energy Deposition

Industry: Aeronautics, Automotive

Website: www.aimen.es



ABOUT AIMEN

AIMEN is a Non-Profit association, which supplies technological support to companies dedicated to industrial or commercial activity related to metallurgy, automotive sector, civil construction, mechanics, shipbuilding, chemicals, foundry, machinery, ceramics, food, cement, wood and its by-products, plastics, engineering, assembly and others. AIMEN promotes and undertakes research, as well as improves manufacturing technologies in these sectors. Located in the Northwest of Spain, AIMEN is a highly professionalized organisation specialised in Materials Science, Manufacturing Process Engineering, Control Engineering, and Laser Processing. Its mission is to improve competitiveness and technology know-how of Manufacturing Industry.

AIMEN PILOT LINE

iM2AM (intelligent Multi-material and Additive Manufacturing) Pilot line by AIM (ES) owning technology for the manufacturing of 3D metal/composite multi-material components by Automated Tape Laying process.

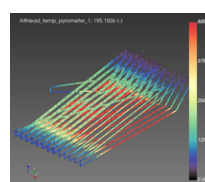
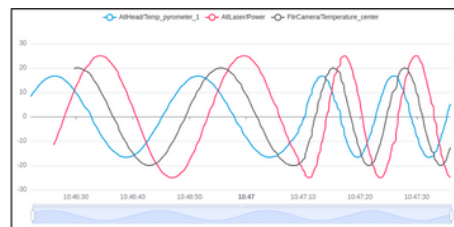
Technologies deployed in this Open Pilot Line focus on process monitoring and orchestration using Asset Administration Shell (AAS) as key enabler for production reconfigurability.



AIMEN's orchestrator tool allows the implementation of Plug and Produce concept as well as process monitoring by modelling the different assets using Asset Administration Shell.



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Check Youtube Video

SERVICES OFFERED



1

Viability study

Production line digitalization using Asset Administration Shell using Orchestrator tool considering particular conditions.

2

Process development

2.1 Process monitoring:

Gathering data of a new sensor/device based on Asset Administration shell and data recording in HDF5 file format.

2.2 Digital Twin:

- AAS: Assets modelling using Asset Administration Shell and following IDTA submodels specifications.
- Product and Process digital twin: visualization of process monitoring data in a 3D model representation.

3

Training

- Basic principles of Asset Administration Shell modelling.
- Guidelines for deploying active Asset Administration Shell using Common Information Models and VDI/VDE 2139.



VALUE PER SERVICE

- Viability study: 10k EUR
- Process and product visualisation via Digital Twin: 80k EUR



DIMOFAC

Laser texturing module for multi-material adhesion promotion



AIMEN IN A NUTSHELL

Founded: 1963

Location: O Porriño (Galicia) Spain

Technology: Laser Texturing

Industry: Aeronautics, Automotive, Energy, Transport

Website: <https://www.aimen.es/en>



ABOUT AIMEN

AIMEN is a Non-Profit association, which supplies technological support to companies dedicated to industrial or commercial activity related to metallurgy, automotive sector, civil construction, mechanics, shipbuilding, chemicals, foundry, machinery, ceramics, food, cement, wood and its by-products, plastics, engineering, assembly and others. AIMEN promotes and undertakes research, as well as improves manufacturing technologies in these sectors. Located in the Northwest of Spain, AIMEN is a highly professionalized organisation specialised in Materials Science, Manufacturing Process Engineering, Control Engineering, and Laser Processing. Its mission is to improve competitiveness and technology know-how of Manufacturing Industry.

AIMEN PILOT LINE

LTMAP (Laser texturing module for multi-material adhesion promotion) by AIM (ES) owning technology for the laser processing of metallic materials for adhesiveless bonding between dissimilar components.



The Laser-based generation of mechanical anchorage points on the metal surface for adhesion promotion. By using a high-productivity nanosecond pulsed fibre laser, it is possible to texture the part under the manufacturing cycle time.

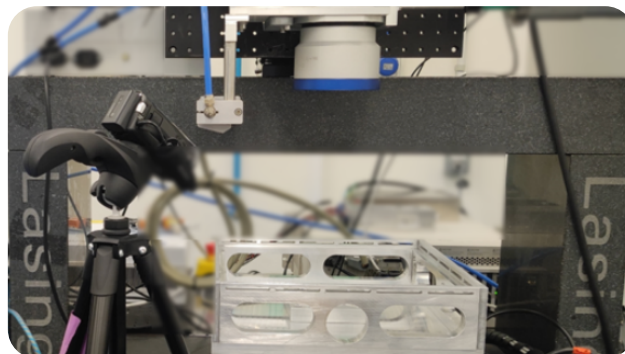
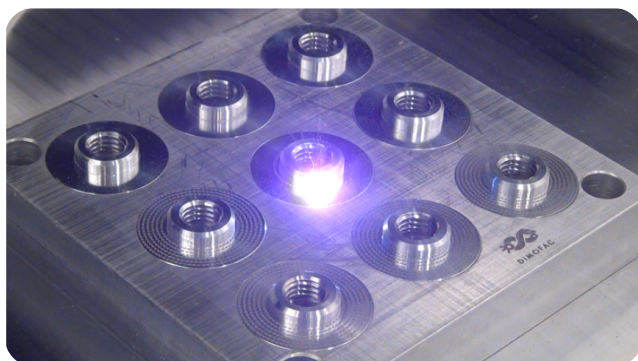


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DIMOFAC

aimen
TECHNOLOGY CENTRE



Check Youtube video



SERVICES OFFERED

1

Viability study

Considering particular conditions of the materials and manufacturing chain

2

Optimization of laser texturing

Strategies to improve adhesion strength between dissimilar materials

3

Manufacturing of initial samples

For validation of the process, complying with quality yield requirements and cycle time.

BENEFITS

It reduces the manufacturing time of hybrid parts by substituting conventional bonding process (applying adhesive and curing) and reduces the risk of sudden failure during the parts service life (failure of adhesive bonding is unpredictable and sudden).



VALUE PER SERVICE

- Viability study (10k EUR),
- Optimization of laser texturing (80k EUR),
- Manufacturing samples (35k EUR)

aimen
TECHNOLOGY CENTRE

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36418 O Porriño (Pontevedra), Spain

<https://www.aimen.es/en> | lucia.alonso@aimen.es | +34 986 344 000

CIVA Platform - Characterization Platform

CEA IN A NUTSHELL

Founded: 1945

Location: Saclay, France

Technology: Additive Manufacturing

Industry: Digital Manufacturing,
Industry 4.0

Website:

<https://list.cea.fr/en/page/civa-simulation-and-analysis-software-for-non-destructive-testing-ndt/>



ABOUT CEA

CEA-List brings together experts in smart digital systems. They are committed to developing high-added-value innovations that respond to the major challenges facing our economy and society. Our R&D programs address the Factory of the Future, digital twins, artificial intelligence, and digital trust. They are backed by innovation and tech transfer mechanisms designed to help our R&D partners stay competitive.

CEA PILOT LINE

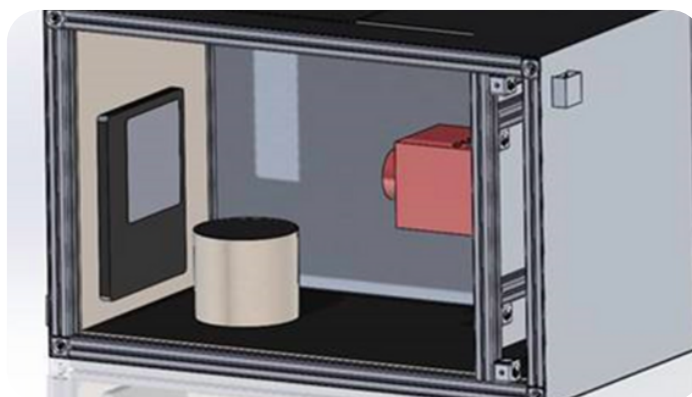
CIVA is the world's leading simulation and analysis software for non-destructive testing (NDT). It is widely used in industry, research, and education to design, optimize, qualify, and study non-destructive testing methods. CIVA can also help improve diagnoses and support the implementation of automated inspection procedures. It can handle all the main inspection techniques.



CIVA is an Additive Fabrication Hub dedicated to exploration of new geometries, lighter-weight materials and structures, advanced functionalization in Additive Manufacturing.



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SERVICES OFFERED



Inspection feasibility for new/complex parts

X-ray inspection for new parts or products. An evaluation study including a report with foreseen performances can be prepared as deliverable.



Characterization service with X-ray tomography

In the scope of product development, the module can be used to characterize a small series of samples in terms of dimensional conformity and the presence of flaws.

BENEFITS



Checks the printed part quality and dimensional checks (external and internal features)

VALUE PER SERVICE



- **Inspection feasibility - Pricing via specific offer/quote, starting with 5k€ for study with simple to medium application cases.**
- **Characterization service with X-ray tomography - pricing via specific offer/quote, starting with 10k€ for study with simple to medium application cases.**



DIMOFAC

ARES Large surface printing platform for flexible electronics

cea

liten

CEA IN A NUTSHELL

Founded: 1945

Location: Grenoble, France

Technology: Flexible Electronics

Industry: IoT, medical, packaging, automotive, smart homes, energy

Website: <https://www.cea-tech.fr/cea-tech/english/Pages/resources-and-skills/technology-platforms/large-area-printing-platform.aspx>



ABOUT CEA

CEA Tech institute Liten covers the entire value chain, from formulating inks and enhancing the printing techniques (screen printing, slot-die, flexography, heliography) used on flexible materials like plastic, paper, and textiles through to layer characterization. The institute recently successfully produced photodetectors, transistors, and sensors (strain gauges) on a flexible plastic substrate.

CEA PILOT LINE

ARES (Large surface printing platform for flexible and hybrid electronics), led by CEA (FR), brings together all necessary advanced printing equipment – vacuum coating, screen printing, inkjet, gravure, flexography, thermoforming tools and slot-die, as well as back-end assembly tools (lamination, pick and place) in a 1000 m² Platform of clean room ISO7 class 10000.



Liten's printing techniques are compatible with large areas (up to 32 cm x 38 cm) and offer the added benefit of being able to develop 2D/3D smart objects functionalized using multiple electronic components on a myriad of substrates (from plastic and glass to paper and stretchable substrates). The electronic functions design can be customized according to the application. As an example, in IoT application, CEA offers technological building blocks such as antenna, sensors and chip bonding enabling the development of smart POC demonstrators able to communicate relevant data to a larger IT system.



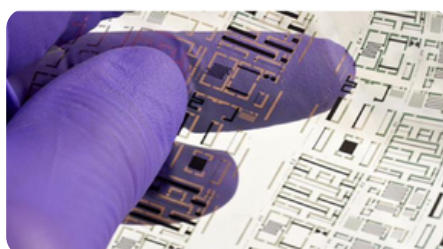
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DIMOFAC

cea

liten



SERVICES OFFERED

● Introduction to printed and hybrid electronics

Introduction to printed and hybrid electronics - 1/2 day training - Overview / Advantages - Manufacturing Process - Technologies portfolio - Applications/ several exemples of Prototypes - Visit of the facilities (clean room). Additional ½ day: The visit might be coupled with a identification of R&D relevant subjects with the visitors.

BENEFITS

- Introduction of functionality in the product for smart and/or traceability applications

VALUE PER SERVICE



- Pricing via specific offer/quote, depending on the audience / number of attendees and technical level



DIMOFAC

SmartFactoryKL DIMOFAC Demonstrator

smartFactory^{KL}

SmartFactoryKL IN A NUTSHELL

Founded: 2005

Location: Germany, Kaiserslautern

Technology: Plug-and-Produce

Industry: Industry 4.0

Website: <https://smartfactory.de/en/>



Promo Video:

<https://youtu.be/ME7CNbMSqZ0>



ABOUT SMARTFACTORYKL

As a pioneer and forerunner, the non-profit SME SmartFactoryKL addresses and presents the paradigms and ICT innovations in manufacturing-related processes, right from its foundation in 2005. SmartFactoryKL works in close cooperation with the Innovative Factory Systems (IFS) at the German Research Center for Artificial Intelligence (DFKI), which is one of the largest non-profit contract research institutes in the field of innovative software technology based on Artificial Intelligence (AI) methods. The IFS department has been active since 1998 in the field of ambient intelligence systems and ICT-based manufacturing. It investigates technologies and standards in automation engineering and human-machine-interaction.

SMARTFACTORYKL PILOT LINE

Innovative key technologies are tested and further developed in realistic industrial production environments. Keywords are Gaia-X (research project smartMA-X), multi-agent systems, artificial intelligence, 5G, system architecture, autonomous systems, module exchange, human-machine interaction, etc. The goal is a flexible, more efficient and sustainable production concept. With this in mind, we have further developed Industry 4.0. We call this update *Production Level 4*.

The demonstrator shows different production and logistics processes in the form of encapsulated capabilities and described by Asset Administration Shells (AAS) following the DIMOFAC common information model (e.g. 3D printer or armrobot). To achieve Plug-and-Produce capability, several modular production resources are accessible via the DIMOFAC platform, where the corresponding AAS are registered and describes the interaction for production agents.



SmartFactoryKL owning a technology-initiative Industry 4.0 production laboratory for mass customisation and Plug-and-Produce for future smart factories. Its strength lies in its open network of modules, which can be continuously expanded by new research projects. In this way, different research questions can be explored on the basis of the exemplary process and implemented with industry-realistic hardware.



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SERVICES OFFERED



- 1 Practical Demonstration of the use of AAS, Middleware and hardware
- 2 Research on AAS models to be used and improved in research projects
- 3 Close exchange with industry partners and development of joint use cases
- 4 Demonstration of the testbed on fairs, open days and interest groups

BENEFITS

Solving challenges of industry 4.0 like Plug and Produce scenarios, skill-based engineering, digital twins. The main benefit is the possibility of pre-industrial testing and validation to show possible and realistic scenarios.

VALUE PER SERVICE



- SmartFactory^{KL} is non-profit and does not sell services
- All results and activities are organised with the industrial partners and through research projects

Intelligent injection moulding Pilot line



IPC IN A NUTSHELL

Founded: 2016

Location: Lyon, France

Technology: Injection Moulding

Industry: Plastic

Website: <https://ct-ipc.com/>



ABOUT IPC

IPC is the Technical Centre of the French plastics and composites industry, with more than 3000 SMEs directly connected to IPC. As such, IPC is in charge of providing the plastics and composites industry with innovative and high added value facilities and manufacturing pilot lines, cutting edge expertise and services. IPC covers the full industry value chain with its key fields of expertise including design and simulation of parts and processes; advanced injection moulding and tooling; thermoplastics materials; composites materials; plastronics. Main markets addressed today encompass automotive, consumer goods, aeronautics, health, packaging, connectors, house appliances, horology. Developing new value chains is a key strategic issue with focus e.g. on micro / nanostructured plastic parts, microsystems on plastics; smart composites; multi-materials additive manufacturing.

IPC PILOT LINE

This pilot aims to produce plastic parts by injection moulding process. The configuration of it consists of combining a mould, a material, an injection machine and a thermal controller. Setting and monitoring the process are based on the exchange of data between different Asset Administration Shells of the pilot assets. It also includes a Digital Twin of the injection process. The online quality inspection of plastic parts just after their moulding is also included. It consists of three different QC stations based on non-destructive technologies and one traceability station. The implementation of Asset Administration Shells makes it possible to exchange data to configure the workcell, save the QC results and traceability of the parts.



Pilot line by IPC (FR) owning technologies for intelligent injection moulding for production of plastic products. The pilot line integrates data collection from multiple assets, namely injection machine, mould, engraving device and a dedicated inspection system for quality control. A digital twin of the injection moulding machine enables the calculation of advanced markers for process supervision.



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SERVICES OFFERED

1 Manufacturing Audit

AAS developement of specific asset used in plastic manufacturing - Evaluate (time, cost, deay) the feasibility of module within a plastic factory.

2 Test before invest

Process recipe development - Configure the pilot line to company who would like to test module before investment. In that case The company have to provide a mold.

3 Product manufacturing with manufacturing data

Manufacturing of initial product for validation of the process, and production of process and quality windows

4 Workshop

Demonstration of the Pilot line

BENEFITS

(Re)Configuration, preparation and supervision of Manufacturing of plastic product

(Re)Configuration and preparation of quality inspection devices for plastic products

VALUE PER SERVICE



- **Demonstration of the Pilot line – Free**
- **Manufacturing Audit - 2/3 days of IPC workforce in client premises**
- **Test before Invest - TBD**

TECNALIA OpenHouse

tecnalia

MEMBER OF BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

TECNALIA IN A NUTSHELL

Founded: 2011

Location: Bilbao, Spain

Technology: Laser

Industry: Automotive, Aeronautics

Website:

<https://www.tecnalia.com/en/scopes-of-action/smart-manufacturing>



ABOUT TECNALIA

TECNALIA is the largest center of applied research and technological development in Spain, a benchmark in Europe and a member of the Basque Research and Technology Alliance. Collaborates with companies and institutions to improve their competitiveness, people's quality of life and achieve sustainable growth. The main scopes of action are: smart manufacturing, digital transformation, energy transition, sustainable mobility, personalised health, urban ecosystem and circular economy.

TECNALIA PILOT LINE

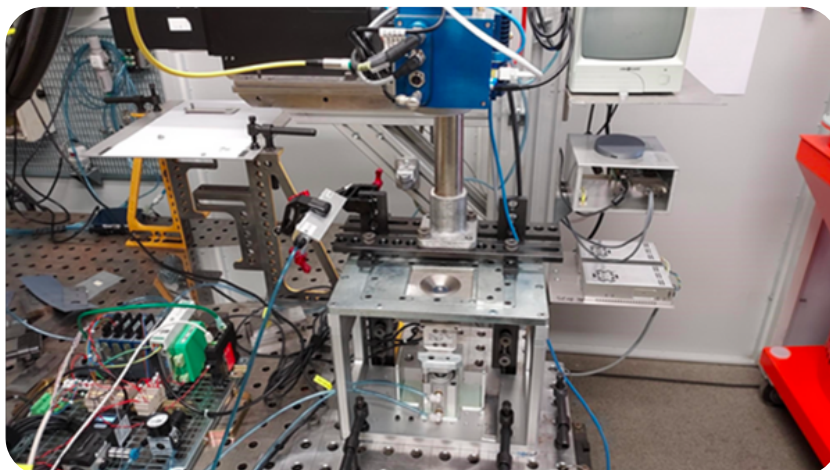
In TCN OpenHouse the laser head, laser source, infrared camera for process control and a specific clamping device are integrated. The data generated by these devices is injected into an implementation based on Intrasoft platform and thus into a generic database. The implementation uses AAS (Asset Administration Shell) technology for digitally representing the objects of the machine. The database serves as input into an analytics module that controls whether the laser process is right or wrong and has or not to be stopped and the decision is sent to the laser control module.



TCN OpenHouse is composed by laser technology for joining composite-metal components, flexible clamping devices, process monitoring and robotic handling. The implementation based on Intrasoft platform that uses AAS modelling for digitally representing the sensors of the machine is novel and currently being in a research phase on European projects.



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SERVICES OFFERED



1

Viability study

Viability study and setup of the process of join fiber reinforced thermoplastic composites to metals

2

Process Monitoring

Pre-series and/or process integration at end user facilities - Very limited pre-series production only for quality validation. TECNALIA will transfer the technology to the client for own production.

3

Training

Training of process viability, setup and integration

4

Analytics

Analytics based on digital twin AAS model.



VALUE PER SERVICE

- Viability is free of charge except if complex fixing systems will be needed. Materials and fixing tooling will be provided by the client.
- Pre-series and/or process integration at end user facilities - After viability confirmation, TECNALIA and the client will agree the scope and the price for technology transfer.
- Analytics based on digital twin AAS model will need the establishment of a specific scope and price with the client.

Swiss Smart Factory Lighthouse Industry 4.0 production ecosystem



Switzerland Innovation Park

Founded: 2017

Location: Biel, Switzerland

Technology: IoT, Industry 4.0

Industry: MedTech, Watch

Industry, small production

Website: <https://www.sipbb.ch/en/>



SWITZERLAND INNOVATION PARK

Switzerland Innovation Park Biel/Bienne (SIP-BB) is a multidisciplinary non-profit R&D organisation (SME) that operates the Swiss Smart Factory (SSF). Swiss Smart Factory (SSF) is Switzerland's leading and internationally recognized competence center in application-oriented research on "Industry 4.0" and "Internet of Things". The SSF has been created in May 2017 as the first and only Digital Innovation Hub (DIH) in Switzerland. SSF acts as a regional and national multiplier and facilitator for digital innovations. It supports technology development and transfer from the first idea to the market introduction. Special focus is set on supporting SMEs and start-ups with the uptake and introduction of ICT innovation – both from technology and business perspective

SWITZERLAND INNOVATION PARK PILOT LINE

3D Printer Farm

The 3D Printer Farm shows how to digital retrofit existing machines, different technologies like, OPC-UA, REST-API, IO-LINK, Low-Code are in use here and can be experienced. Here the standardized OPC-UA Datamodel is used as an CIM. Each of the nine 3D printer modules have their AAS, and are connected to the DIMOFAC Platform thanks to their OPC-UA servers.

Manual workstation

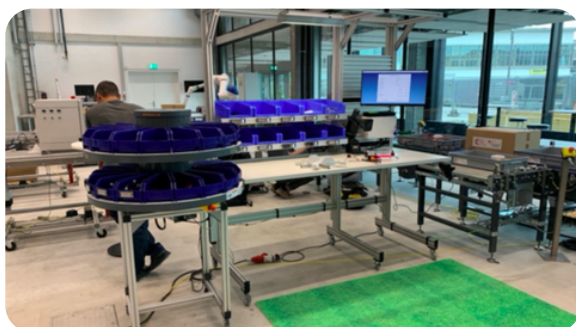
Our manual workstation is helping the worker in their daily production tasks, it allows to keep the quality at a high level and allows fast introduction to new product configuration. Thanks to the product AAS the manual workstation can reconfigure automatically following the specification of the lot sized one product.



Swiss Smart Factory Lighthouse Industry 4.0 by SSF (CH) represents an IoT-based, end-to-end production scenario addressing the requirements of high-wage, high-value manufacturing in Switzerland.



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SERVICES OFFERED

1

Consultancy

- Smart Worker Guidance - How can my organization help employees to be more efficient
- OPC-UA Datamodelling - How can I develop an OPC-UA datamodel (CIM) for my machines, and its AAS
- Digital retrofit- How can my organization get data out of "old" machines
- Low-code - What are the possibility with Low-code application in my organisation
- Cobotic- Where can my organisation use a cobot
- RFID - Where can my organisation use digital logistic

2

Process development

- On-site analysis and development of digital strategies

3

Pre-series

- Support during the development of prototype IoT Integration
- Support during the development of prototype automation system

4

Training

- Low-Code programming
- Digital Lean Production
- Big Data and Data Analytics
- Cobotic automation

VALUE PER SERVICE



- **Consultancy – 10k EUR**
- **Process development – 80k EUR**
- **Pre-series - 35k EUR**
- **Training – one day 5kEUR**



DIMOFAC

Factory Explorer



Brainport Industries
Campus

BPT Industries Campus IN A NUTSHELL

Founded: 2014

Location: Eindhoven, The Netherlands

Technology: Asset Administration
Shell

Industry: Manufacturing

Website:

<https://www.brainportindustriescampus.com/en/>



ABOUT BPT INDUSTRIES CAMPUS

BPT Industries Campus (NL) by BPT Industries and TNO: The biggest (60.000 m²) and fully privately funded low volume manufacturing facility in the Netherlands. It has a joint investment of 24 million euro's and more than 90 partner companies. Brainport Industries Campus is a unique location in the Brainport region, where various companies in the high-tech manufacturing industry, education and knowledge institutions are located.



BPT INDUSTRIES CAMPUS PILOT LINE

Digital Factory is a three-dimensional model in which all business assets are connected to each other and within the supply-chain. We then record all assets, equipment and processes in a so-called Asset Administration Shell (AAS), organised into standardised submodels drawn from, among others, the CIM. This allows you to digitally steer and manage processes even better. Ultimately, such an AAS can develop into a Digital Twin, to create simulations and predictions, to further optimize your production process.



The Factory Explorer makes the AASs hosted in, e.g., the DIMOFAC Platform easily to inspect for varied purposes, such as browsable, viewing, and analyzing. The graphical interface part of the Factory Explorer goes beyond the functionality offered by other AAS tools, so we expect the Factory Explorer to be necessary across use cases. The tool also facilitates custom dashboards for custom views on the AAS data and custom selection procedures based on, e.g., implemented CIM submodels.



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SERVICES OFFERED

1

Consultancy:

- Viability Check with applicant for implementation of Factory Explorer
- Asset Administration Shell
 - Asset modelling based on I4.0 standards and/or use-cases
 - Curated Submodels provided by CIM and IDTA
 - Verification & validated of AAS models
 - AAS connector-based integration with ERP, PLM, machines, etc.
- DIMOFAC AAS Platform design & implementation

2

Process Development

- Factory Explorer
 - Deployment & operation of the Factory Explorer tooling
 - Backend integration with DIMOFAC Platform
 - Development of AAS-integration connectors
 - Manufacturing operations Management (MoM) based process integration

3

Training

- Asset Administration Shell
 - Asset Administration Shell core principles & operation (incl. APIs)
 - Guidelines for CIM- and standards-based modelling & semantics
 - AAS connector-based integration

BENEFITS

The Factory Explorer allows you to explore Admin Shell (AAS) enabled Assets in real-time and create purposeful custom dashboards. Browsing, viewing and analyzing Admin Shells can be a hassle, but we aim to make it effortless.



VALUE PER SERVICE

- Consultancy (10k EUR)
- Process Development (80k EUR)
- Training TBD

Flexible Processing & Assembly Robotic Framework

LMS IN A NUTSHELL

Founded: 1994

Location: Patras, Greece

Technology: Machining, Milling

Industry: Manufacturing

Website:

<https://lms.mech.upatras.gr>



ABOUT LMS

Laboratory for Manufacturing Systems & Automation (LMS) is oriented on research and development in cutting edge scientific and technological fields. LMS has been involved in a number of research projects in a variety of disciplines funded by the EC and European industrial partners. Particular emphasis is given to the co-operation with the European industry as well as with a number of "hi-tech" firms. LMS currently employs approximately 70 researchers organized in three different groups: a) Innovative Manufacturing Processes, b) Robots, Automation and Virtual Reality in Manufacturing and c) Production Systems Planning, Control & Networking.

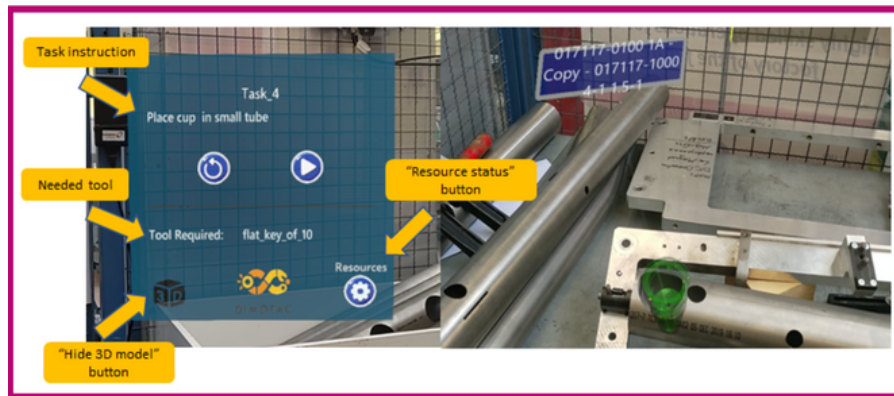
LMS PILOT LINE

FPARF - Flexible Processing & Assembly Robotic Framework by LMS (EL), owning a number of conventional and non-conventional process modules (CNC milling, turning, welding, EDM, Additive Manufacturing) as well as multiple industrial, cooperative and mobile robots. For demonstrating and training people interested to the DIMOFAC solution and its related developments, the following modules have been selected, based on which, several services are offered:

1. AR Instructions for Operator Support module

The development focuses on the implementation of an AR application to support human operators during various production phases. Main focus is given on providing virtual instructions regarding the task to be performed through the AR Glasses both in terms of text instructions as well as holograms of the parts to be handled that superimpose the operator's field of view. Target of this is to minimise training needs for the human operators when introduced to new tasks or new product variants while also reducing the scrap rate by reducing the possibility of errors during process execution.





List of Services:

- **Consultancy:** Feasibility study on AR applications utilisation - 100 EUR/application
 - Provide insight regarding the implemented system (added value, requirements, etc.)
- **Training:** AR workshop – 500EUR/applicant
 - AR utilisation
 - Unity familiarization
 - Create digital instructions
 - Load and generate digital models/animations

2. Small parts assembly module

The development focuses on the implementation of a highly flexible and reconfigurable module that include all the required skills to perform assembly of small parts. The operation of the deployed robots is enhanced by the use of a Digital Twin for real time sensor data gathering and exchange. This information is used for the real time robot motion planning eliminating the need for preprogramming the robots. In terms of scheduling and orchestrating the actions of the robots, a scheduling algorithm is utilised that exploiting the DIMOFAC CIM-based modelling of the production entities in ISA-95 compatible format (JobOrder, JobResponse, Equipment modelling, etc.) produces the detailed Production schedule to be executed by the robots. This scheduling system exposes the outcome via the AAS for the Process Orchestrator (the DIMOFAC orchestration systems) to consume it and manage the schedule execution by communicating the actions to be performed to the assigned robotic resources.





DIMOFAC



LMS

Laboratory for
Manufacturing Systems
& Automation

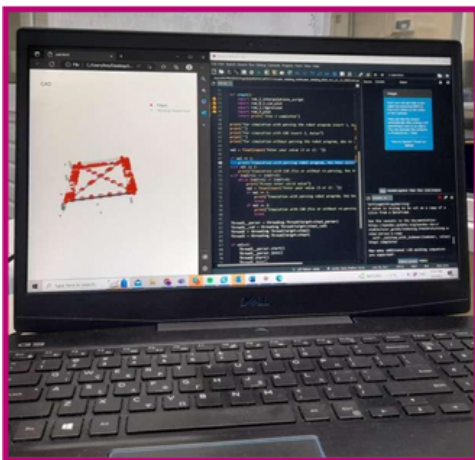
List of Services:

- **Consultancy:** Feasibility study on multi-robot assembly utilisation - 200 EUR/application
 - Provide insight regarding the implemented system (added value, requirements, etc.)
- **Training:** Reconfigurable multi-robot assembly Workshop – 500EUR/applicant
 - ROS framework familiarization/DT implementation
 - Object detection methods/techniques



3.Laser Welding module

On this module, the developments focused on creating add-on functionalities for the reconfiguration of the laser welding module. Trainees may get in touch with a non-invasive gap detection system, responsible for measuring the gaps between parts before welding, and with a rapid simulation tool responsible for calculating the weld bead dimensions achieved by the selected process parameters. The simulation is mostly automatically performed, through parsing the robot welding program.



List of Services:

- **Consultancy:** Consultancy: Feasibility study on zero-defect laser welding applications – 200EUR
 - Provide insight regarding the implemented system (added value, requirements, etc.)
- **Process Development:** Process parameters selection for mass customizable laser welded products – 4000EUR per material
 - Process development on client's application, for optimizing the process parameters selection
- **Training:** Zero-defect laser welding Workshop – 500EUR/applicant
 - Gap detection system operation/setup
 - Laser welding simulation operation/setup



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870092.

4. Milling Module

In the milling module, the main focus is the digitalization of milling process and the milling machines enabling its monitoring and control. For the control, the chatter is investigated throughout this module, while the workflow followed provides useful information for controlling other milling phenomena.



List of Services:

- **Consultancy:** Feasibility study on machining digitalization- 2000 EUR
 - Provide insight regarding the implemented system (added value, requirements, etc.)
- **Training:** Digital Machining Workshop– 500EUR/applicant
 - Integration of the implemented system on interested party's premises
 - Operation/use of the implemented system on interested party's premises
 - Communication with high-level software (such as MES etc.) through the AAS.

BENEFITS

1. Digitalisation in machining
2. Monitoring and control of chatter in milling
3. Retrofitting existing machines with digital technologies
4. Laser welding process understanding and simulation
5. Easy robot-based assembly module reconfiguration – new product variants introduction
6. Reduced human operators training requirements
7. Reduced scrap rate – production delays due to human errors

Asset Administration Shells (AAS) based Digital Twin pipelines



INDUSTRY 4.0 LAB IN A NUTSHELL

Founded: 1836

Location: Milano, Italy

Technology: Digital Twin

Industry: Manufacturing

Website:

<https://www.industry40lab.org/>



ABOUT INDUSTRY 4.0 LAB



The Manufacturing Group of Department of Management, Economics and Industrial Engineering of Politecnico di Milano created a tangible physical entity where the research activity in the innovative manufacturing management and planning approaches can be carried out in conjunction with a practical implementation in a “real-like” environment: the Industry 4.0 Lab (I4.0 LAB). The manufacturing ecosystem includes three major components to consider: the human factor, the product, and the process/plant. All these three factors need to be considered in a holistic way, to adequately build engineering and management competences. I4.0LAB addresses these three aspects in a flexible and scalable environment.

INDUSTRY 4.0 LAB PILOT LINE



Polimi's I4.0Lab by POL (IT), owning a research entity where manufacturing management and planning approaches can be carried out in conjunction with a practical implementation in a realistic environment where a physical production line and wide robotic equipment are installed. The line is equipped with industrial PLC, sensors, actuators and interfaces to assembly products in an industrial like environment, while the robotic equipment is mainly devoted to serve the line in terms of material handling.

The integration of existing assets into Digital Twins is a traditionally long-lasting activities, which requires several days of interviews and investigation. Thanks to the introduction of AAS in the digital portfolio of the line, this time has been decreased by an order of magnitude, complementing the wide availability of data for production scheduling, control and analysis.





SERVICES OFFERED

1 AAS assessment

Compliance verification to the latest standards

2 AAS modeling/connection

AAS packages and pipelines development

3 AAS training courses

Various level of courses about AAS (from general knowledge to mastering-level)



BENEFITS

Digitalisation of all the production processes performed by machines on the shopfloor of manufacturing companies.

VALUE PER SERVICE



- AAS assessment - Starting from 5000€, depending on the number of assets
- AAS modeling/connection - Starting from 10000€, depending on the number of assets
- AAS training courses - Depending on the training offer where to be included and on the expected number of attendees