



Platform-ZERO

ACHIEVING ZERO DEFECT MANUFACTURING
FOR THE PHOTOVOLTAIC INDUSTRY

The Manufacturing Partnership Day - 26/09/2023

Victor Izquierdo Roca

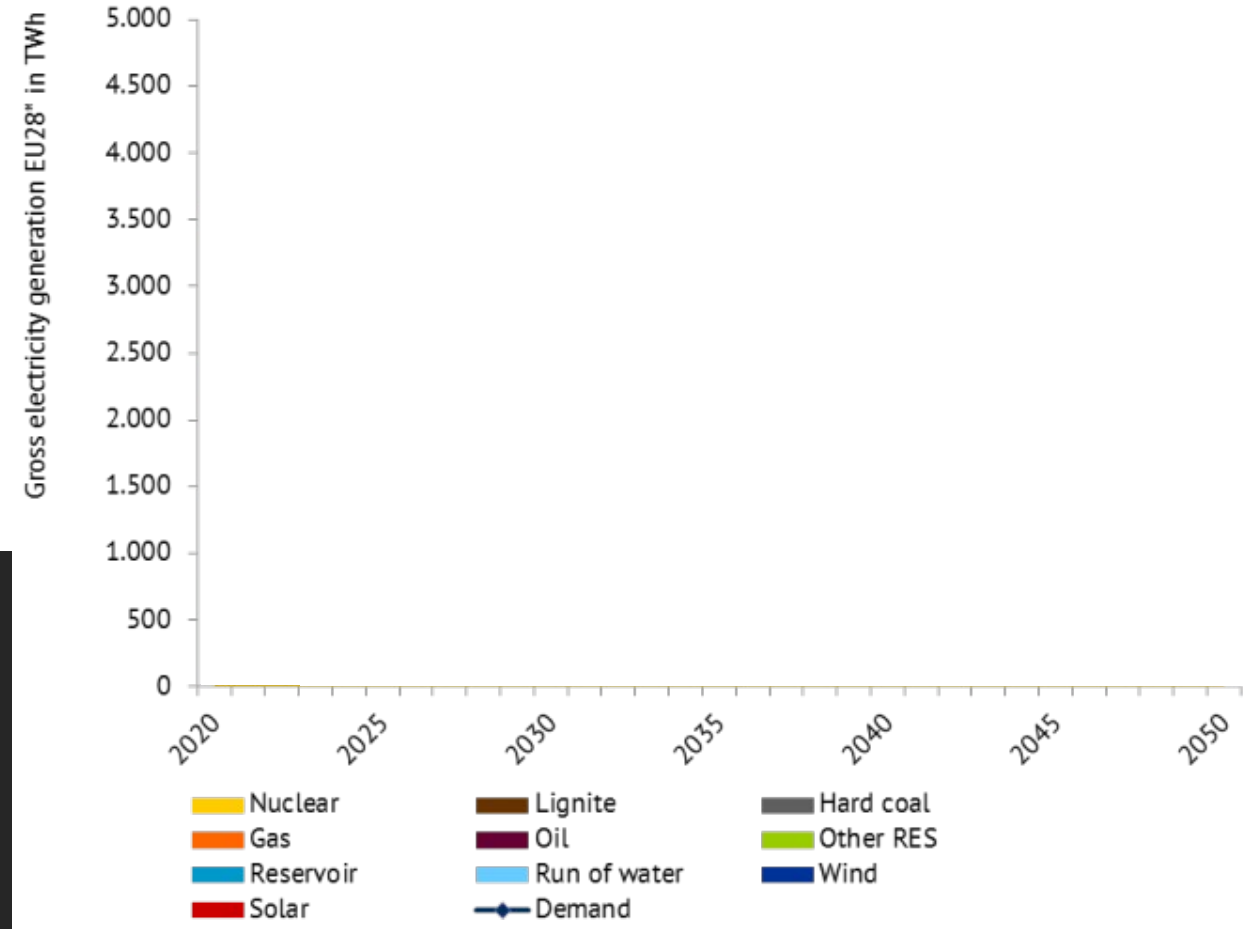


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EU Energy mix

The CONTEXT

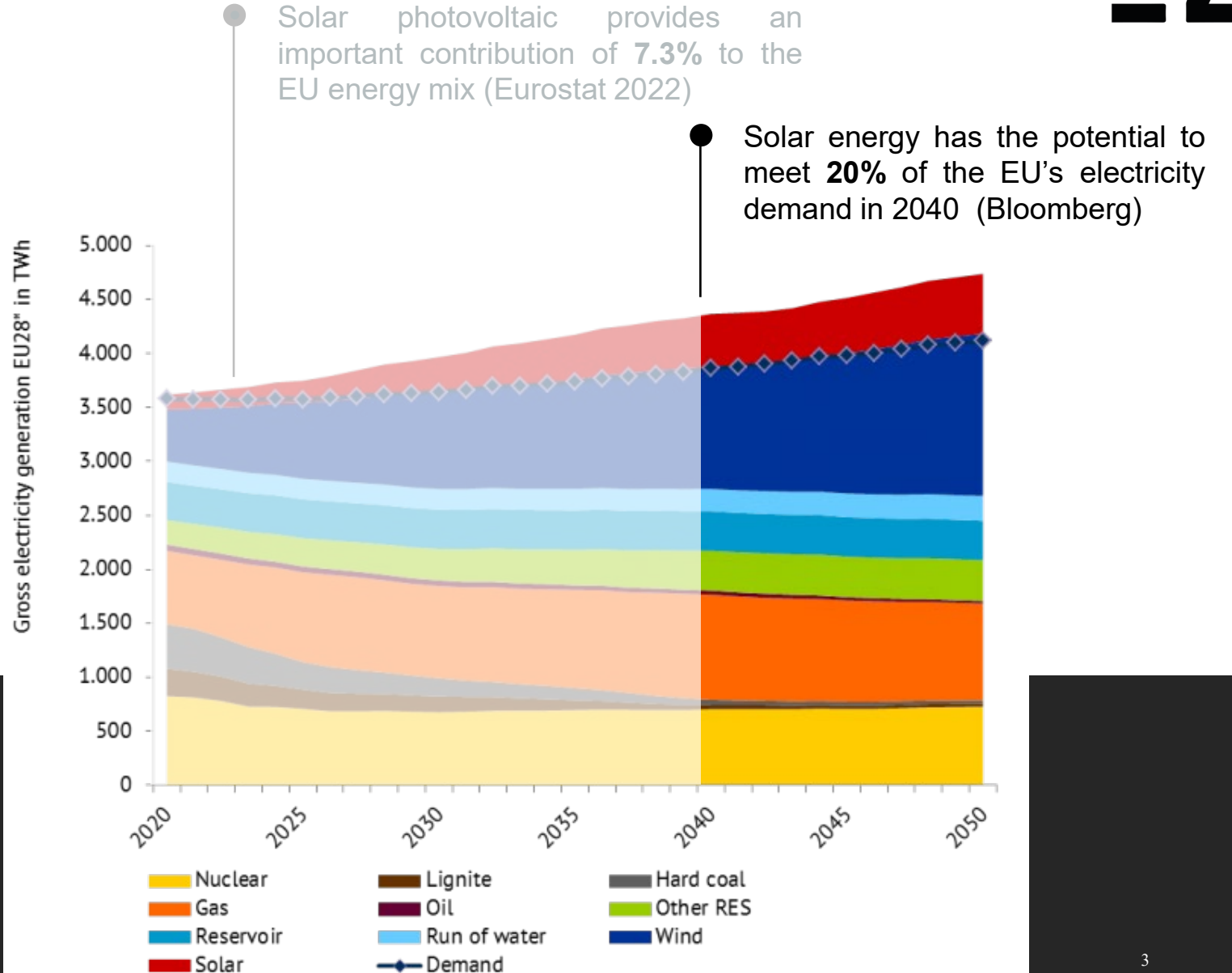




In the NEXT YEARS

... it requires increase the production of EU's PV manufacturing industry

The CONTEXT



Need for a competitive PV industry



The latest PV technologies combine high performance with a strong customizability and flexibility for integration in many applications: buildings, vehicles, agrivoltaics, infrastructures...

Besides production, the competitiveness of EU's PV industry also needs to be increased → new PV technologies with higher quality and performance that provide an added value

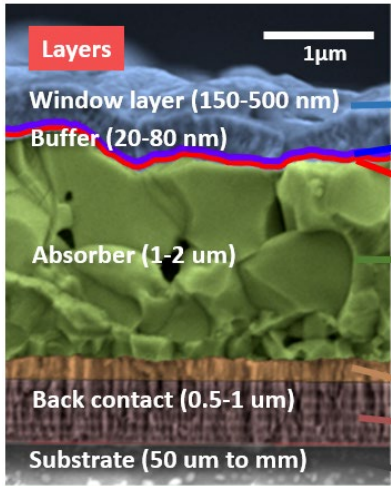
New PV technologies are key for EU's ecologic transition



Towards ubiquitous integration of PV

The CONTEXT

HOWEVER

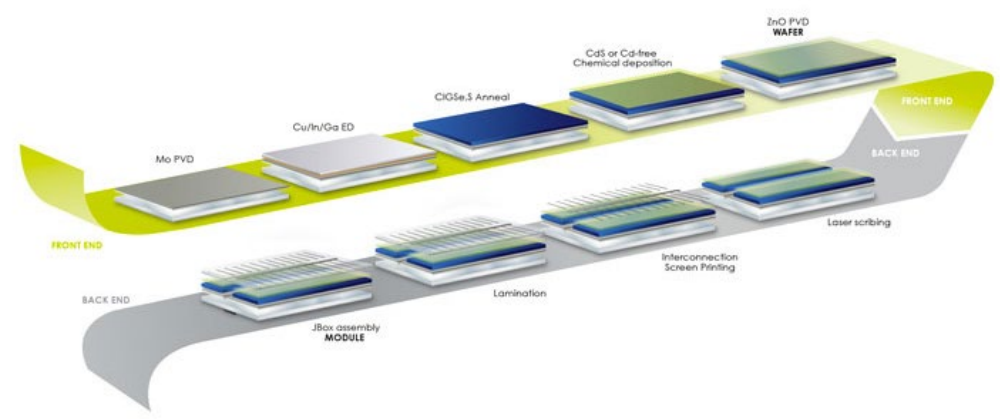


Materials

- ITO, AZO
- $i\text{-ZnO}$, $(\text{Zn,Mg})\text{O}$
- CdS , Zn(O,S)
- Cu(In,Ga)Se_2
- $\text{Cu}_2\text{ZnSn(S,Se)}_4$
- Cu_2SnSe_3
- Sb_2Se_3
- SnS
- Mo(S,Se)_2
- Mo, TCO
- Glass, steel, polyimide

Critical parameters

- Resistivity, transmittance
- Thickness, coverage, composition
- Coverage, doping, band alignment
- Composition, bandgap, thickness, crystalline quality, doping, boundary passivation, secondary phases
- Orientation, thickness, alignment
- Adherence, conductivity
- Composition, thermomechanics



...and complex multi-process, multi-technique production processes

This complexity makes PV devices prone to the appearance of critical **defects during manufacturing**, leading to significant **production waste and low quality**

The latest generations of PV present a high-complexity: multi-layer, multi-material, micro- and nano- stack structures...

It is necessary to progress towards the digitalization of PV industrial manufacturing → Process Monitoring

The CONTEXT

The PROJECT

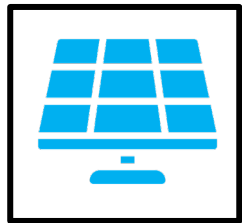


Platform-ZERO...

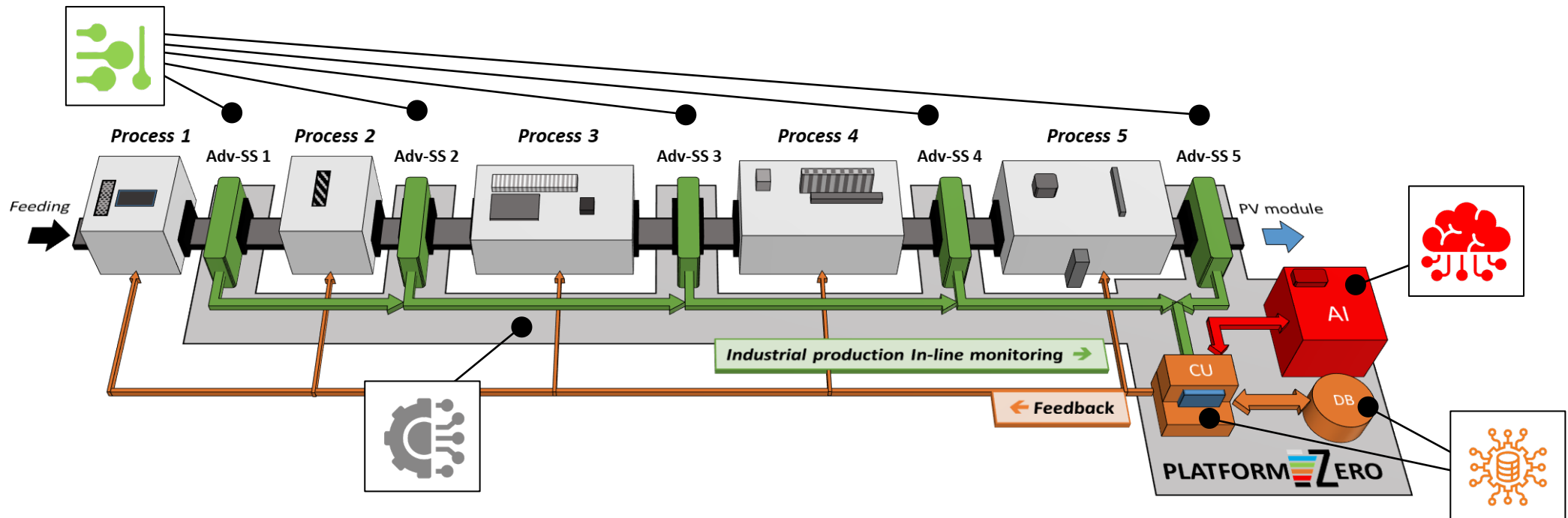
...develops a new customizable in-line process monitoring platform, supported by Artificial Intelligence, for achieving zero-defect manufacturing for the PV Industry

HE Grant agreement ID: 101058459 Start date: 1-1-2023 → End date: 31-12-2026

<https://www.platform-zero-project.eu/>
<https://cordis.europa.eu/project/id/101058459>



PV industry



The AIMS

Create dedicated optical and spectroscopical based sensors compatible with fast non-destructive in-line monitoring in the PV industry



1) Development of advanced sensor stations



The AIMS

Create non-supervised methods
for fast data analysis, data
management and decision-
making using AI and big data
management



1) Development of advanced sensor stations



2) AI system for autonomous monitoring and control



3) Implementation of a big data management infrastructure and control system



The AIMS



Develop automatized modular
and customizable process
monitoring platform prototypes
with easy industrial integration

1) Development of advanced sensor stations



2) AI system for autonomous monitoring and control



3) Implementation of a big data management infrastructure and control system



4) Implementation and installation of functional process monitoring platforms



The AIMS

Demonstrate the effectivity of the technology in real operation conditions (4 demonstrators) for increasing PV productivity by:

- 1) Minimizing the economical and ecological impact of production waste
- 2) Improve production quality of PV devices



1) Development of advanced sensor stations



2) AI system for autonomous monitoring and control



3) Implementation of a big data management infrastructure and control system



4) Implementation and installation of functional process monitoring platforms



5) PV manufacturing optimization





Expected direct impacts:

- 10% increase in productivity of the EU's PV industry
- 10% decrease in consumption of high-value critical raw materials

Expected indirect impacts:

- Provide new tools for optimization the EU's semiconductors industry
- Provide solutions for research acceleration through automatized methodologies and technologies for materials and devices inspection and analysis

OUTCOMES



The Consortium



Projects is developed by

- Four research centers and one university with a strong knowledge in the development of spectroscopic methodologies, imaging, artificial intelligence and data management
- A Metrology SME with strong know-how in the implementation of industrial process monitoring applications
- Two SMEs in charge of dissemination, exploitation and communication actions





The Consortium

...and the innovations will be tested and demonstrated at TRL 7 in 4 PV industrial pilot plants across Europe





PHASE 01
Mapping
6 month

Definition of industrial specifications and reference sample fabrication

PHASE 02
Development of platform elements
1.5 years

Advanced sensor station design & development

AI System development

Data Management & Control Unit Development

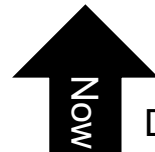
PHASE 03
Implementation
1 years

Platform Implementation & installation of demonstrators

PHASE 04
Testing
1 year

Test and Validation of Demonstrators

Start Date
1-1-2023



Design and testing of concepts

End Date
31-12-2026

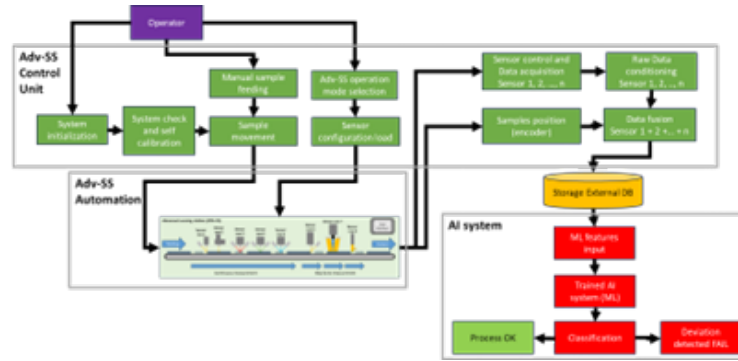
TECHNICAL MAPPING & METHODOLOGY



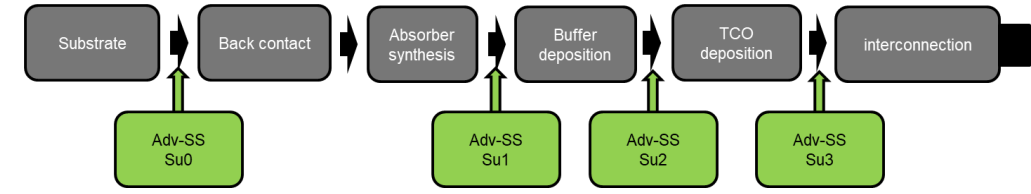
PHASE 01
Mapping
6 month

Definition of Industrial Specification and Reference sample fabrication

Definition of full process monitoring flow of the Platform-ZERO process monitoring platform as well as the specifications, requirements and constraints of the implementation of the process monitoring platform at the different 4-demo sites.



Fabrication of reference samples.



Inspection time

Space weight limitations

size thickness

Sample format
Others

Measurement configuration

MAIN PROJECT RESULTS (9 month)

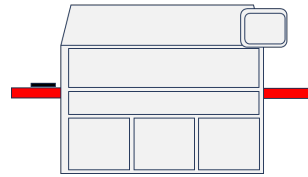
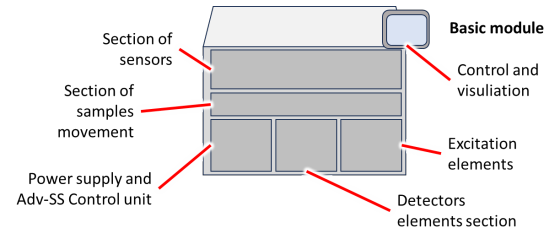
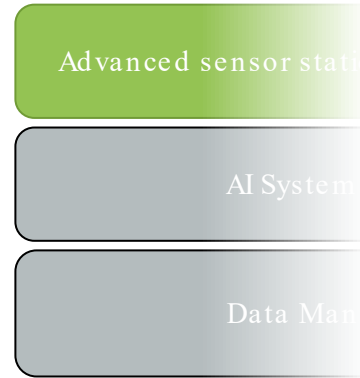


Advanced sensor station design & development

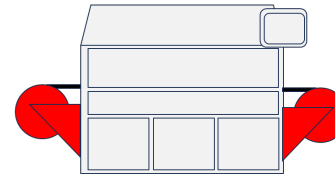
PHASE 01 Mapping 6 month

Definition of Industrial
Specification and
Reference sample
fabrication

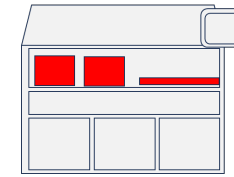
PHASE 02 Development 1.5 years



StS configuration (conveyor)



RtR configuration (Roll control)

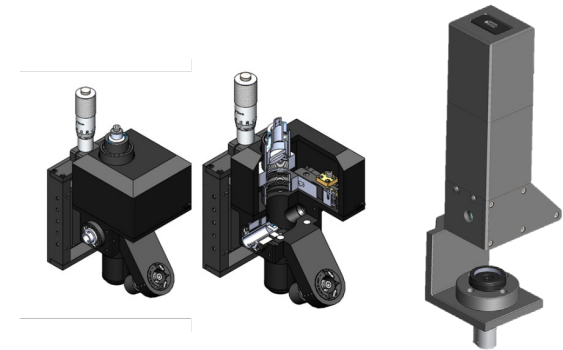


Stages configuration

Design of a sensor station architecture easily customizable to different production configurations:

- ❖ Sheet-to-Sheet
- ❖ Roll-to-Roll
- ❖ "Stages"

Start the design of integrable optical and spectroscopical sensors



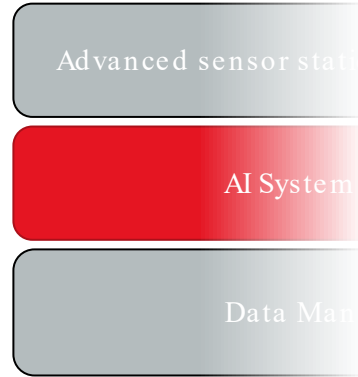
MAIN PROJECT RESULTS (9 month)



PHASE 01 Mapping 6 month

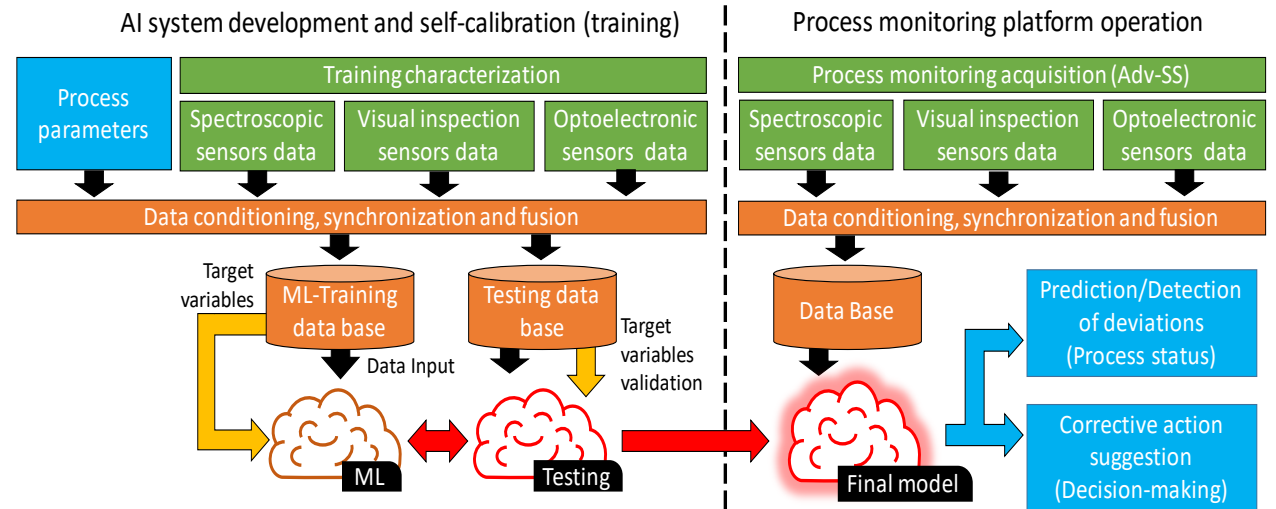
Definition of Industrial
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PHASE 02 Development 1.5 years



AI System development

Design and definition of AI flow diagram including the training mode and operation mode



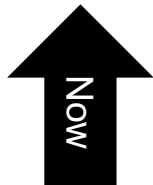
MAIN PROJECT RESULTS (9 month)



PHASE 01 Mapping 6 month

Definition of
Industrial
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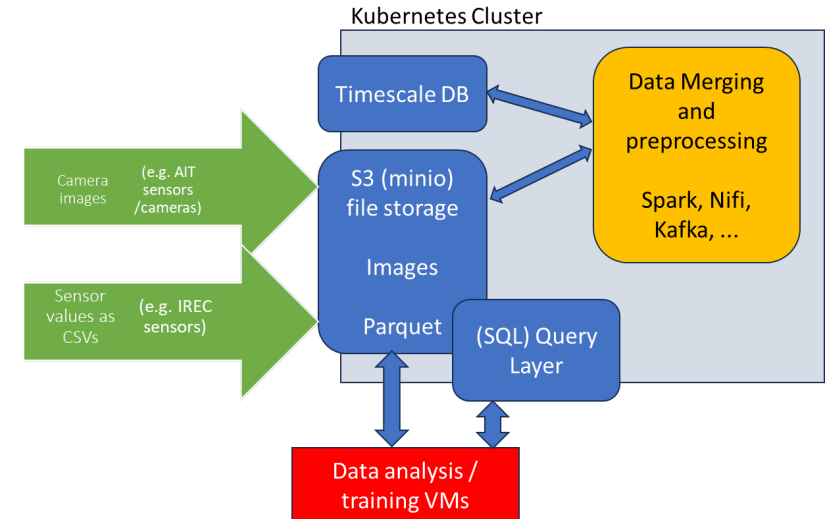
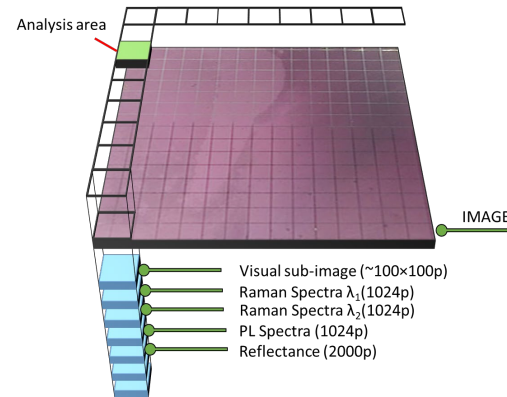
PHASE 02 Development 1.5 years



Data Management & Control Unit Development

Creation of protocols for data fusion and tracking

Design of 1st version of DB architecture and data management infrastructure



MAIN PROJECT RESULTS (9 month)



PHASE 01
Mapping
6 month

Definition of Industrial
Specification and Reference sample fabrication

PHASE 02
Development
1.5 years

Advanced sensor station design & development

AI System development

Data Management & Control

DESIGN OF SEMI-AUTOMATIZED
MODULAR SENSORS
PROTOTYPES

FEB
2024

DESIGN OF SENSORS FOR ADVANCED
SENSING STATIONS
1ST GENERATION AI IMPLEMENTATION

MAY
2024

2ND GENERATION AI
IMPLEMENTATION

OCT
2024

SEP
2023
GENERATION OF
FIRST DATABASE

MAR
2024
FABRICATION OF SECOND
REFERENCE SAMPLES

JUN
2024
UPDATE OF THE 2ND
GENERATION DATABASE



FUTURE ACTIONS (12 month)



Co-funded by
the European Union



6th month meeting
Wrocław (Poland)



THANK YOU, GET IN TOUCH!



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WWW.PLATFORM-ZERO-PROJECT.EU

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