
Could
you
imagine...


... a
costly
production
line?

CONTEXT

- Solar photovoltaic provides an important contribution of **3.1%** to the EU energy mix (Eurostat)
- Solar energy has the potential to meet **20%** of the EU's electricity demand in 2040 (Bloomberg)
- The latest PV technologies combine high performance with a strong flexibility for integration in buildings, vehicles & agrivoltaics devices
- PVs high-complexity makes them prone to the appearance of critical defects, leading to significant production waste

CONTEXT

- Small deviations
- Critical manufacturing defects
- Waste of high-value materials
- Product evaluation?
- Off-line
- Or
- In-line at isolated production steps

Platform-ZERO

Monitoreo inteligente de líneas de producción de celdas solares:

Proyecto Platform-Zero como ejemplo de la vinculación de la ciencia con la industria

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2023/08/25

Renán Escalante

Co-funded by
the European Union

ABOUT 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
- Projects innovations will be tested in 4 PV industrial pilot plants across Europe
- The project aims to:

  ✓ Substantially lower PV fabrication costs
  ✓ Improve production quality of PV devices

- Tackling the challenging issue of **reducing PV manufacturing defects** through the **development of a self-learning, modular and customizable in-line process monitoring platform** that provides an **in-situ holistic production assessment and control employing non-destructive inspection methods and industry 4.0 Artificial intelligence (AI)-based tools** to allow an **early detection, correction and/or prevention of pre-critical production faults.**

Strategic objective

PARTNERS

12 European Partners:

No.	Participant organization name	Short name	Type	Country	Role
1	Catalonia Institute for Energy Research	IREC	RTO	Spain	Coordinator
2	Austrian Institute of Technology GmbH	AIT	RTO	Austria	WP leader
3	Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg	ZSW	RTO	Germany	WP leader
4	R2M solution SRL	R2M-IT	SME	Italy	WP leader
5	R2M solution	R2M-FR	SME	France	Task developer
6	Lurederra	LUR	RTO	Spain	Task developer
7	Sunplugged Solare Energiesysteme GmbH	SUN	SME	Austria	WP leader
8	Lenz Instruments S.L.	LENZ	SME	Spain	WP leader
9	RISC software	RISC	RTO	Austria	WP leader
10	Helmholtz-Zentrum Berlin für Materialien und Energie	HZB	RTO	Germany	Task developer
11	Universidad Pablo Olavide	UPO	RTO	Spain	Task developer
12	Saule Technologies	SAU	SME	Poland	Task developer

PARTNERS

12 European Partners:

IREC Shaping Energy for a Sustainable Future

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

ZSW

R2M RESEARCH TO MARKET SOLUTION

Lurederra centro tecnológico

sunplugged

LENZ INSTRUMENTS

RISC Software GmbH

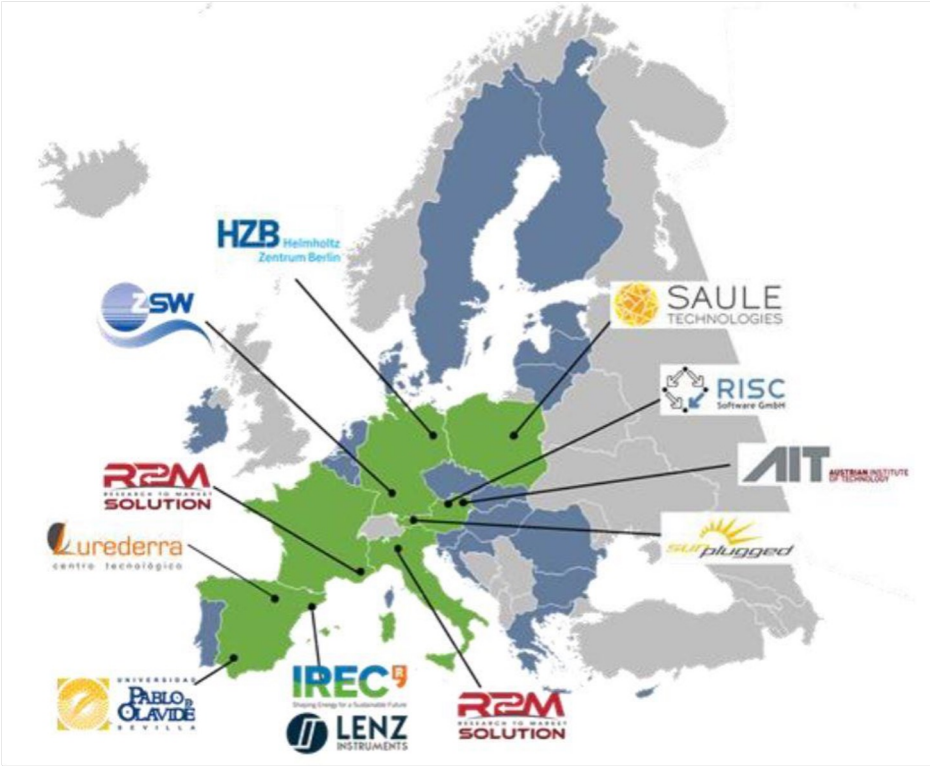
HZB Helmholtz Zentrum Berlin

UNIVERSIDAD PABLO DE OLAVIDE SEVILLA

SAULE TECHNOLOGIES

THE CONSORTIUM

- **Four research centers** and **one university** with a strong knowledge in the development of spectroscopic methodologies, imaging, artificial intelligence and data management
- **Two research centers** with strong know-how in advanced PV technologies and with industrial pilot line facilities
- **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



Platform-Zero

OBJECTIVES

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

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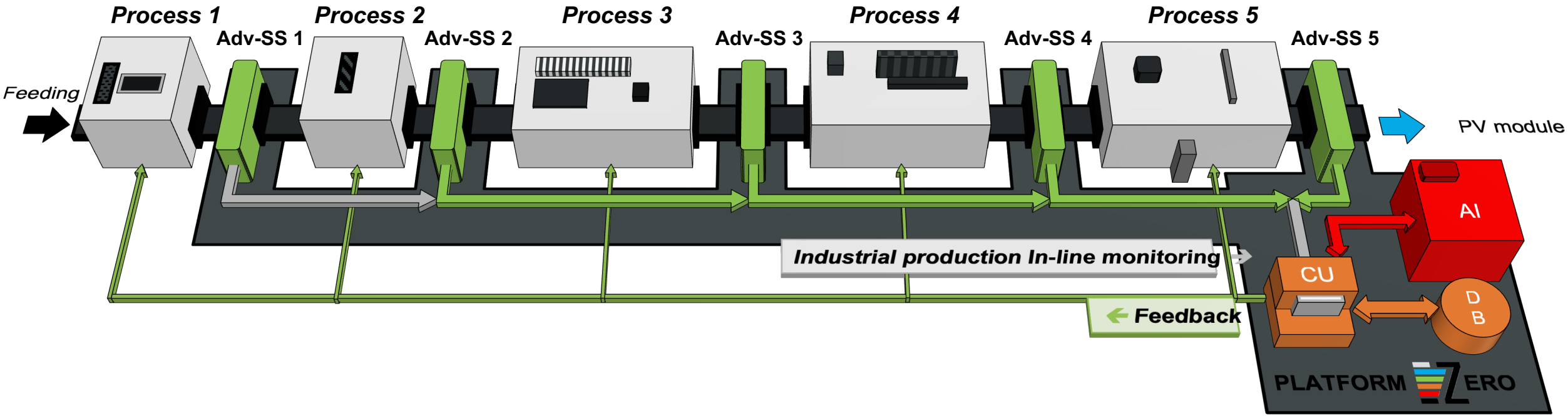
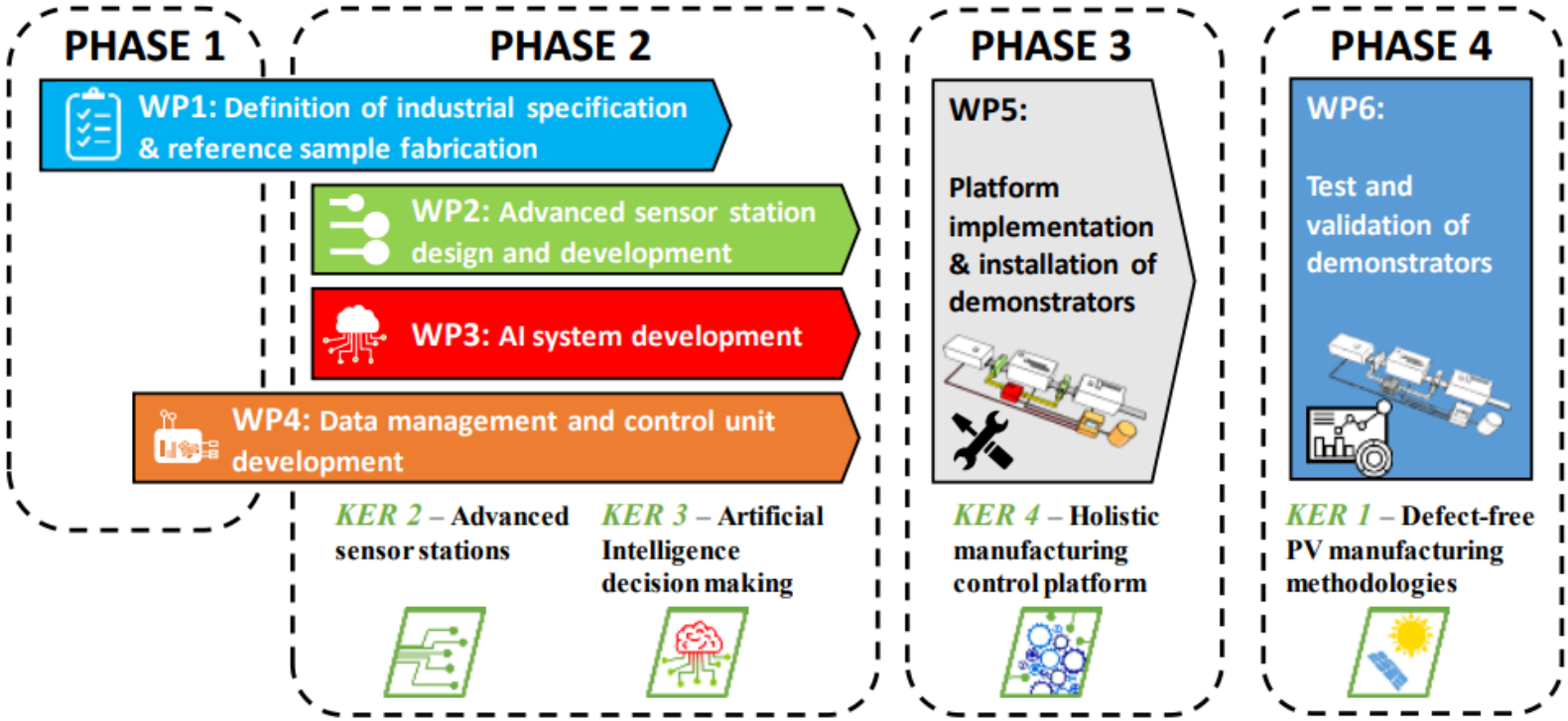

Process 1
Process 2
Process 3
Process 4
Process 5
Adv-SS 1
Adv-SS 2
Adv-SS 3
Adv-SS 4
Adv-SS 5
Feeding
PV module
AI
CU
D
B
Industrial production In-line monitoring
Feedback
PLATFORM ZERO

TECHNICHAL MAPPING & METHODOLGY

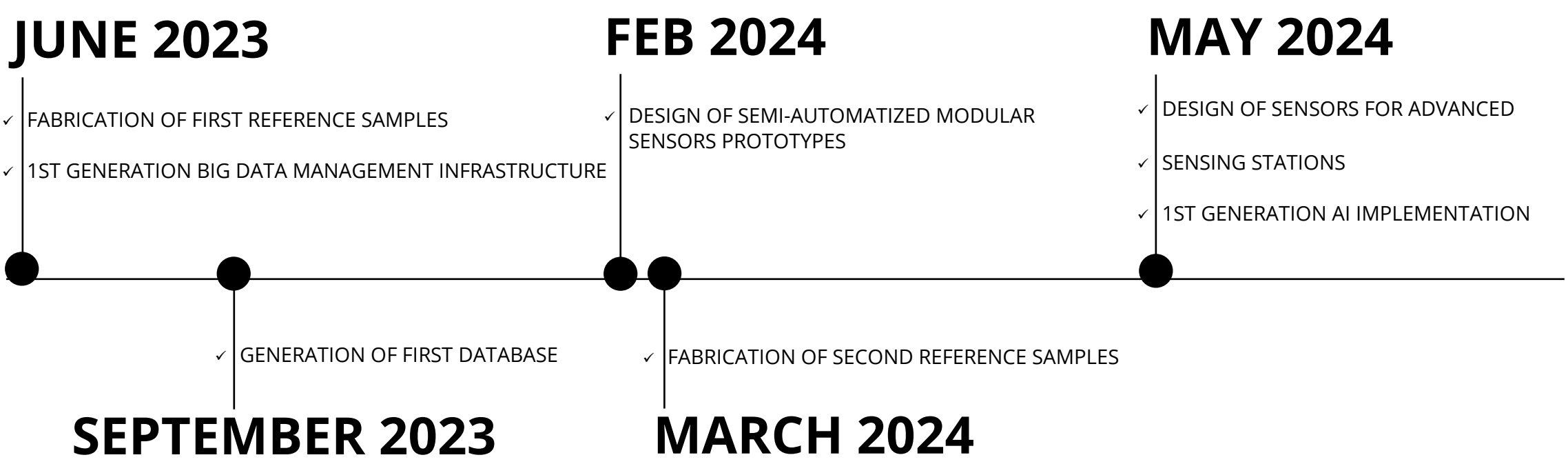
4M approach

- Mapping (year 1)
- Manufacturing (year 2)
- Making (year 3)
- Monitoring (year 4)

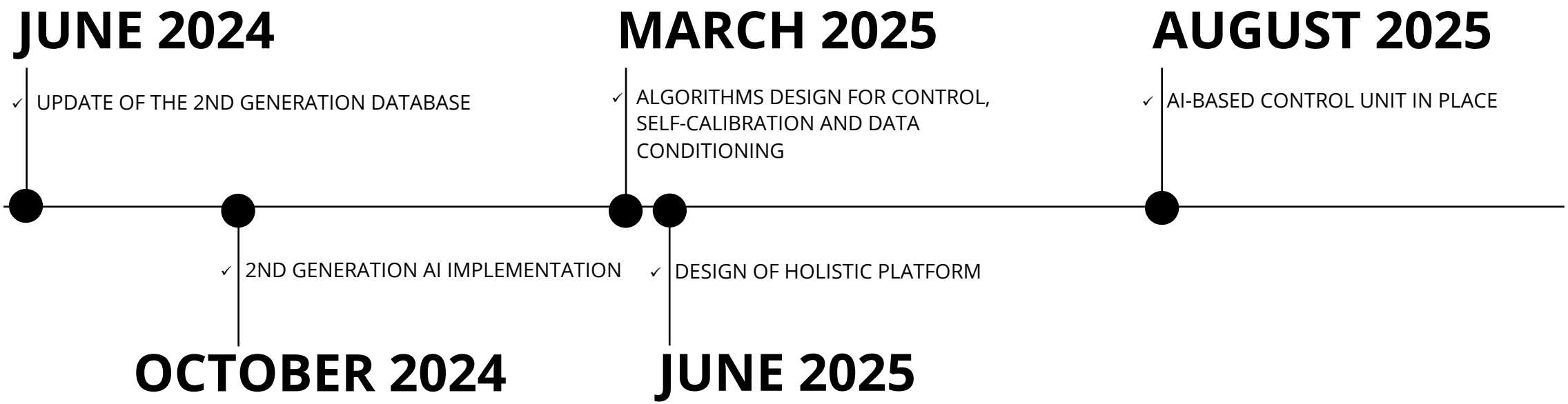


TRL7

TIMELINE (2023-24)



TIMELINE (2024-25)



DEMONSTRATORS

Platform-ZERO innovations will be tested in 4 PV manufacturing lines throughout Europe

Smart coatings for PV

Lurederra — Spain

High efficiency CIGS solar modules

ZSW — Germany

Customizable CIGS flexible solar foil

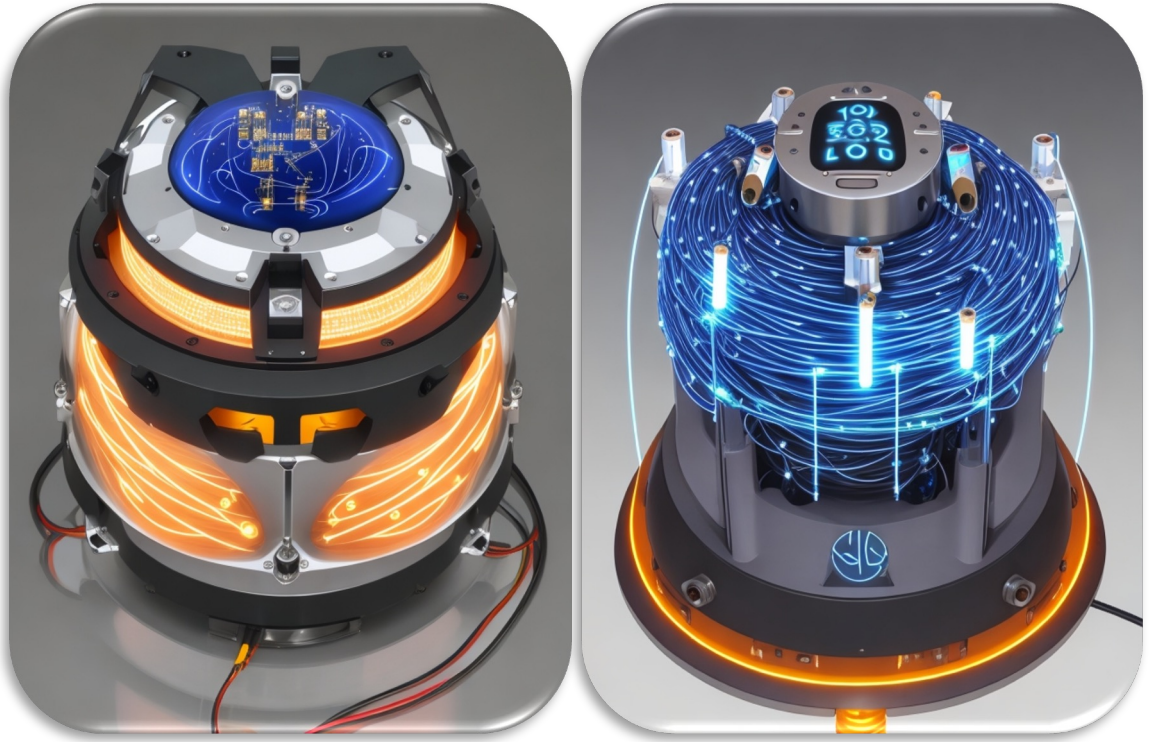
Sunplugged — Austria

Perovskite solar modules

SAULE — Poland

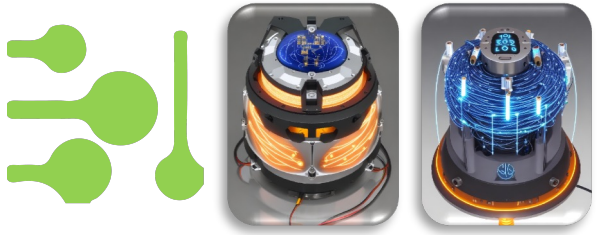
What are we going to do?

- IV
- EQE
- Impedance?



Advanced sensor station design and development → WP2

Why?



- State of the art: There are no multi-sensor solutions available in the market…

- Most are based on conventional process sensors (pressure, temperature, etc.) hindering the collection of information of the characteristics of the manufactured materials in real time or at intermediate manufacturing steps.

- Advanced material characterization can only be performed off-line resulting in limited representativeness (randomly selected units), long analysis time, and slow response time to implement corrective actions.

- The limited available in-line inspection is commonly performed using a small number of non-interconnected sensors that generate a low amount of heterogeneous data that require a complex and mostly manual interpretation. These data provide only a partial understanding of the production.

- The limited in-line sensors employed present rigid designs based on a single technique and a complex and time-consuming calibration protocols that hinder their adaptation to modification or upgrades

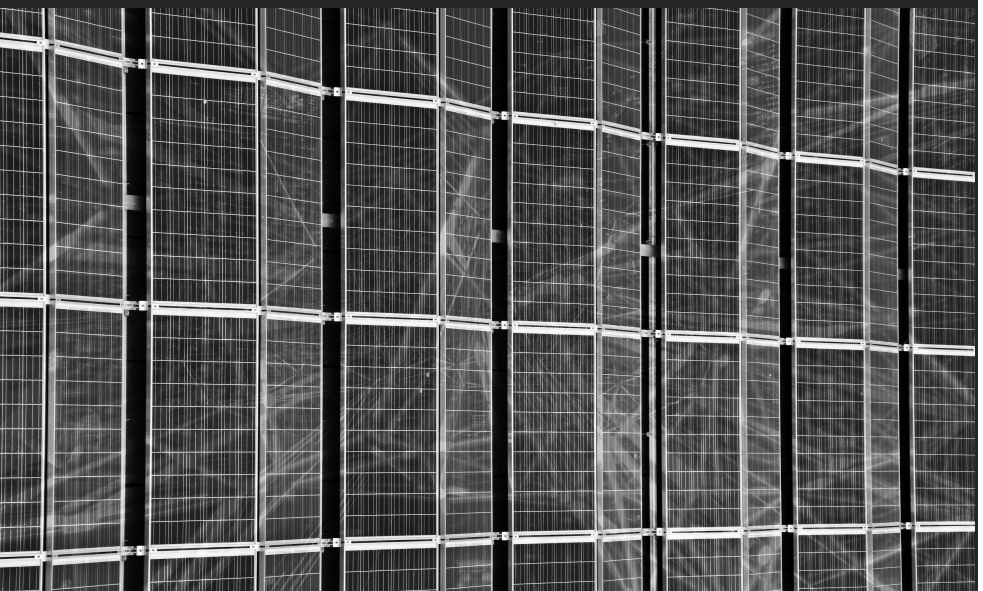
- **Increase of sustainable PV production through improved control systems**
- **Tools to prevent the generation of defects at different production stages**
- **Diagnostic methodologies for in-line monitoring of industrial PV production**
- **Increase of efficient use of materials and reduced related product production costs**

Expected impacts:

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

OUTCOMES

PROJECT KPIs



1) Sensor's sensitivity to deviations >5%

2) Monitoring flow capability

3) Implementation of AI-based algorithms library

4) Implementation of data management and control algorithms library

5) Implementation of GUI software for monitoring, data visualization and decision-making advising

6) Implementation of fully operational platform demonstrators compatible with a real-time industrial process monitoring

7) Detection of process deviations

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THANK YOU, GET IN TOUCH!

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