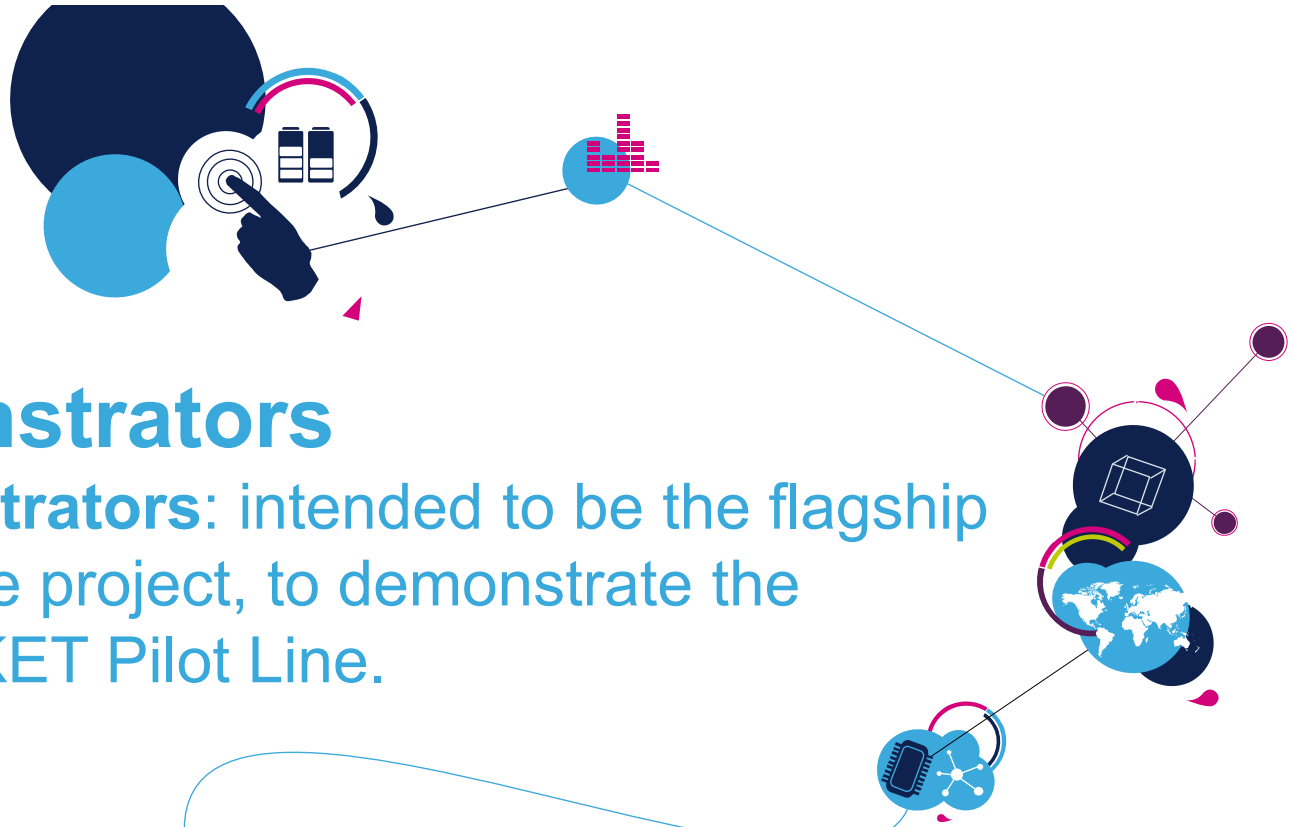

WP5: Demonstrators

10 Final Demonstrators: intended to be the flagship test vehicles of the project, to demonstrate the outcomes of the KET Pilot Line.

Leader: GPTech

Co-leader: ST-I

WP5: Demonstrators

Final Technology Demonstrators		
#	**Application Driven**	**Leader**
D1	Automotive: Safe cut-off device for electric automotive supply	Bosch, FhG (DE)
D2	Electronic speed controller (ESC) for Electric-vehicle applications.	Automatix, ITE (POL)
D3	Renewable Energy, low power converters interfacing renewable PV energy production and storage.	GPTech, UniSE (ES)
D4	Domotic, Dimming lights actuator	IMA (CZ)
D5	Controller and BLDC MOSFET Pre-driver for Automotive application	ST-I
D6	Industrial, brushless DC Motor Controller (BLDC)	BUT (CZ)
D7	Power-management evaluation platform	Nano Design (SK) STUBA
#	**Equipment and Industry 4.0**	**Leader**
D8	New solutions for ALD equipment @300mm	Picosun (FI), ST-I
D9	Pushing Industry 4.0 through the new Fab automation and Rapid ramp allowing defectivity inspection and yield optimization	AMIR, AMIL, ST-I (IR)
D10	D10. Packaging: advanced 3D System-in-Package	APC (NL)

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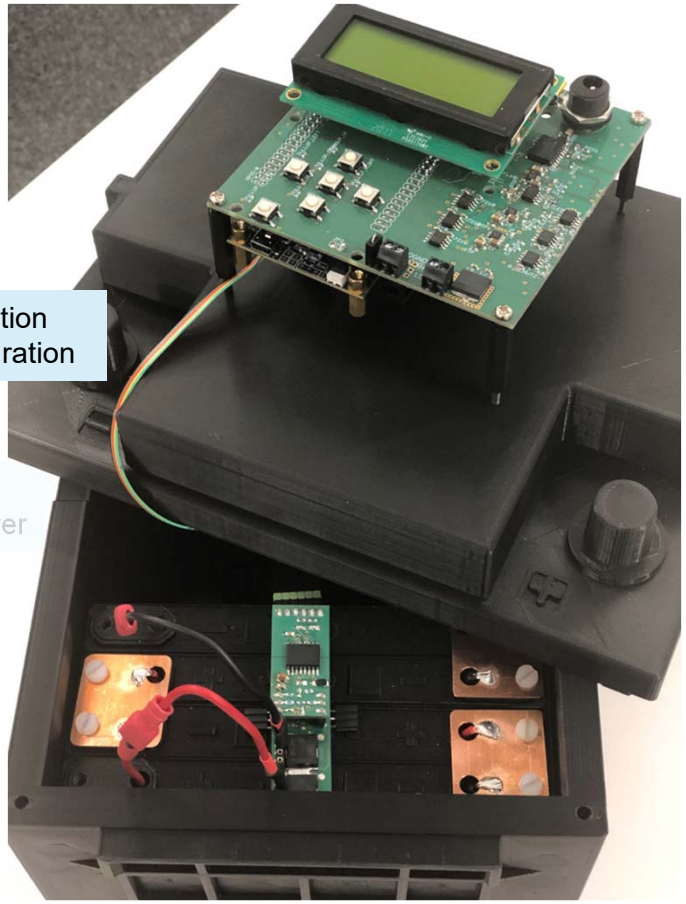
WP5
Application Driven Demonstrators

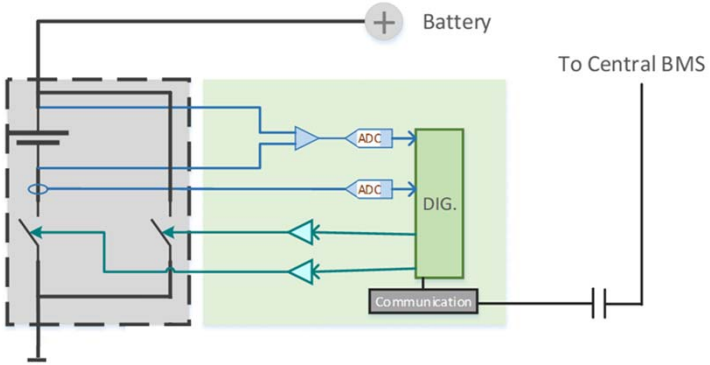
D1. Automotive: Safe cut-off device for electric automotive supply
Bosch, FhG (DE)

- **Battery mngt demonstration**
  - Portable and safe evaluation and characterization by dummy cells
  - Demonstration of component functionality
  - System integration at potential customers
- **Evaluation kit**
  - High power demonstration
  - Evaluation at customers within their systems

Safe evaluation
@ first integration

Verification
@ high power





D2. Electronic speed controller (ESC) for Electric UAV applications. Automatix, ITE (PL)

Łukasiewicz
Instytut Technologii Elektronowej

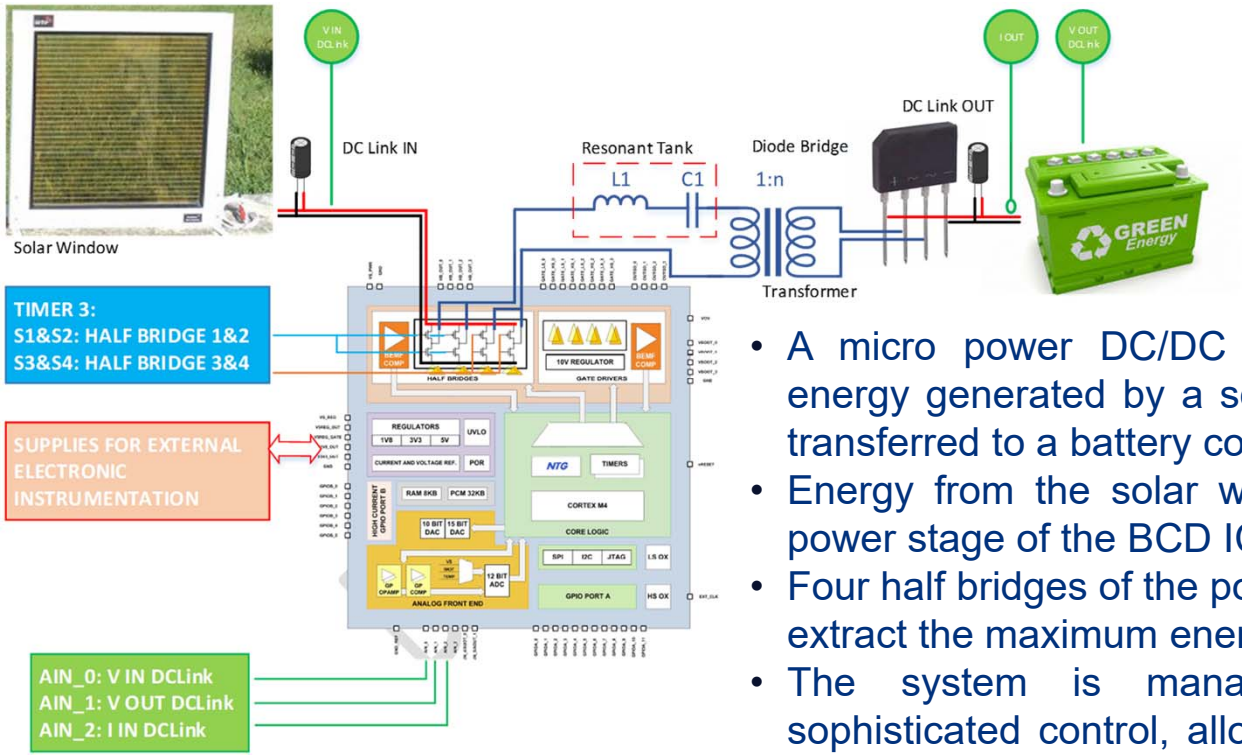
TestBed

- Propeller and BLDC motor have been changed to match current and voltage characteristics available from BCD9
- 2nd version of the Test Bench for testing of the interaction between the control system and various brushless motors has been built to support various configurations to cover the set of predefined/agreed test scenarios:
  - The cRIO-9049 controller by National Instruments has been used to run system model and introduce disturbances
  - The Zynq-7000 All-Programmable System-on-Chip (**APSoC**) as an Electronic Control Unit (**ECU**)
  - ARM® Cortex®-M3-based PSoC® 5LP as Motor Control Unit (**MCU**)

Optimezed Hardware-In-the-Loop methodology (HIL) has been implemented

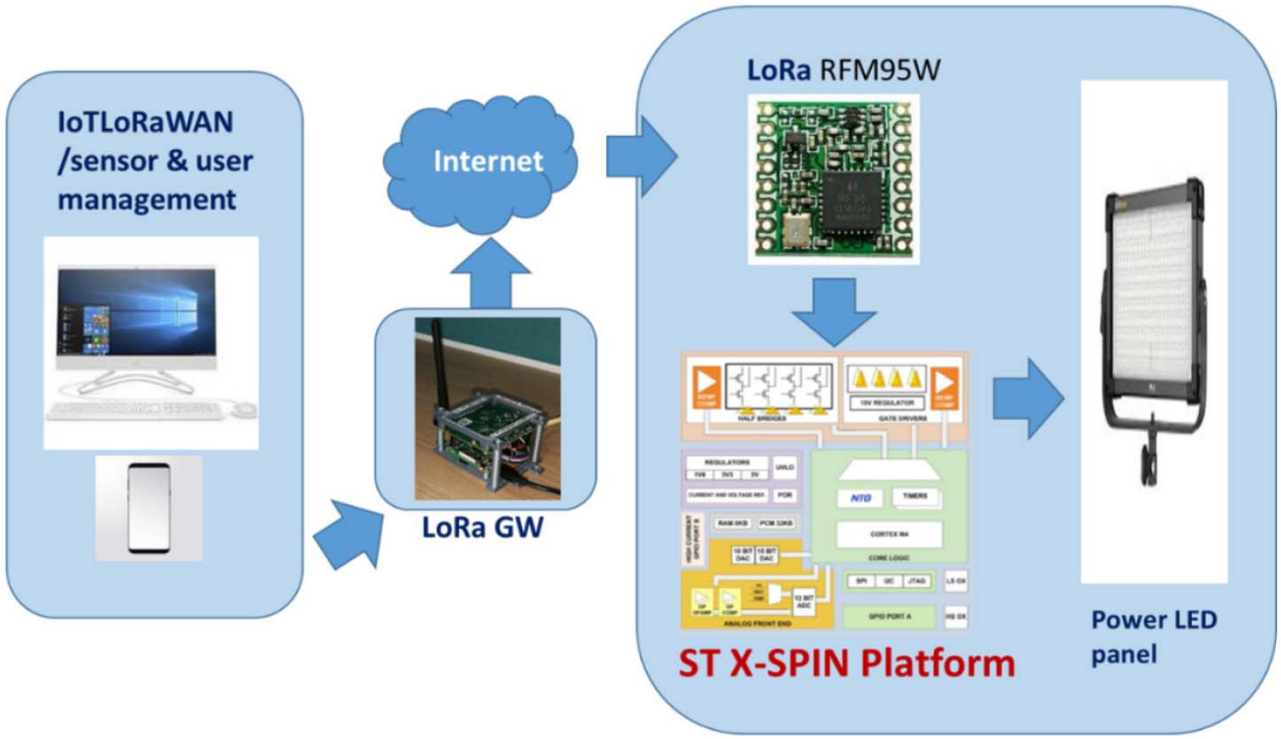
D3 – Renewable Energy, low power converters interfacing renewable PV energy production and storage

GPTech, UniSE (ES)



- A micro power DC/DC converter to manage the energy generated by a solar window. The energy is transferred to a battery connected to the DC bus.
- Energy from the solar window is controlled by the power stage of the BCD IC.
- Four half bridges of the power stage are necessary to extract the maximum energy from the solar window.
- The system is managed by a robust and sophisticated control, allowing to reduce the size of the input capacitor.
- 400V output has been optimized to reduce electrical transmission losses. It is possible to select another type of end application as a wireless charger.

D4 – Domotic, Dimming lights actuator IMA (CZ)



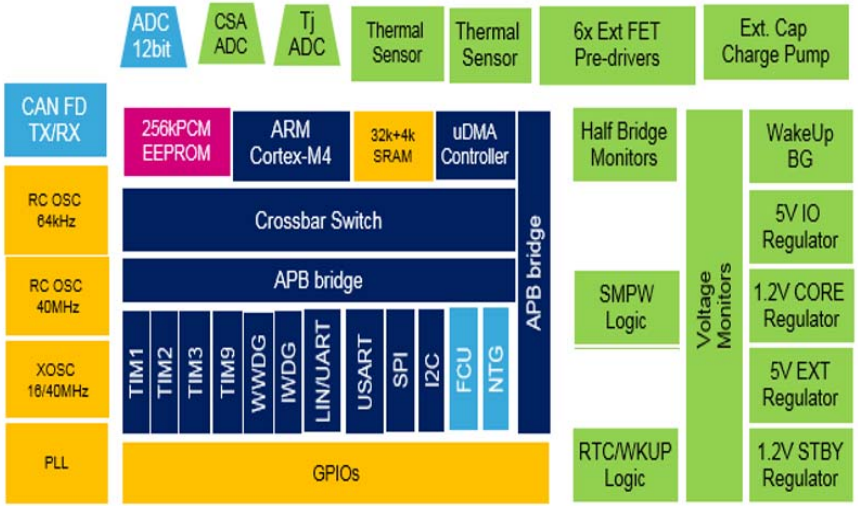
Smart dimming actuator

IMA designed new LoRa module for communication over local LoRa gateway in order to manage the power actuator using IoTLoRaWAN cloud application. The power LED panel was selected in order to fulfil requirements set for Dimming Light Control Platform. Based on R&D outcomes the demonstrator is composed of HW and SW components - XSPIN platform connected to LoRa communication module driving the power LED.

IoT LoRa WAN cloud application for the sensor and user management is up and running. Using the cloud application IMA will plan validation tests in laboratory. The tests will prove the power efficiency of the BCD transistor to drive the power appliance.

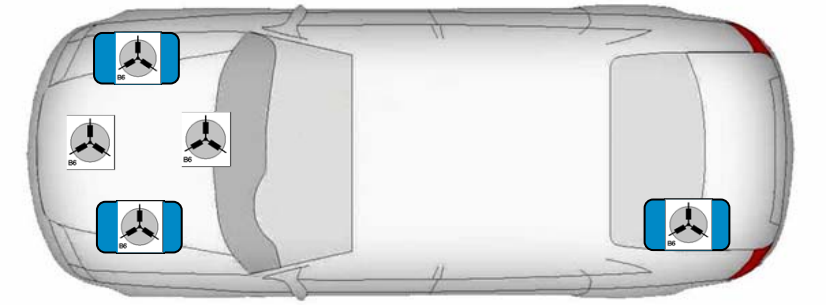
D5 – Smart BLDC MOSFET Pre-driver and Controller ST-I

SoC for brushless motor control
Made on ST's 90nm smart power BCD technology



- 32bit ARM Cortex M4
- CAN FD
- 256KB Phase Change Memory with ECC
- Gate Driver Unit with integrated charge pump
- HW and SW libraries for FOC
- Embedded motor control HW accelerator
- ON/OFF state diagnostics
- Ready for ASIL-A system

Key Highlight



Target applications

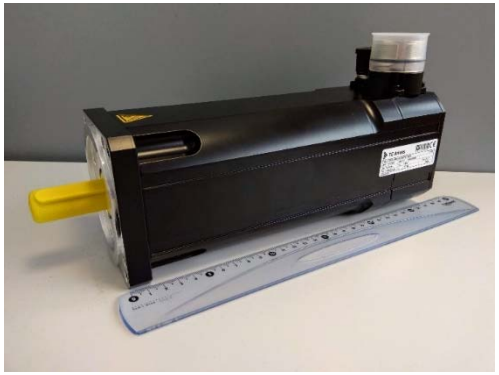
Automotive:

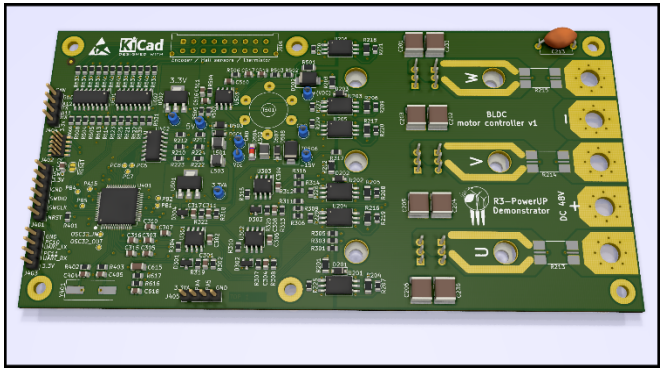
- Electronic Water Pumps
- Auxiliary Water Pumps
- Electronic Oil/Fuel Pumps

Mechatronic BLDC Motor **BLDC *Motor***

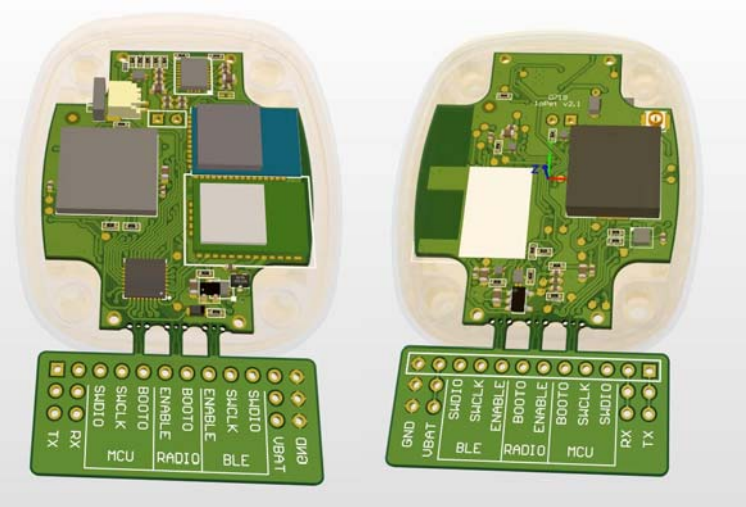
D6 – Industrial, BLDC Motor Controller BUT (CZ)

- Small size BLDC motor controller with high power/size ratio for industrial or automotive applications.
- Output power up to 2 kW at small form factor with DC–link voltage 48 V.
- **Current status**
  - First prototype of the BLDC motor controller based on available components realized.
    - Actually tested with the BLDC motor.
  - Demonstrator presented in two conference contributions:
    - DOI: 10.1109/EDPE.2019.8883916 and DOI: 10.1109/EDPE.2019.8883877
  - Demands on the finalization of the demonstrator summarized.

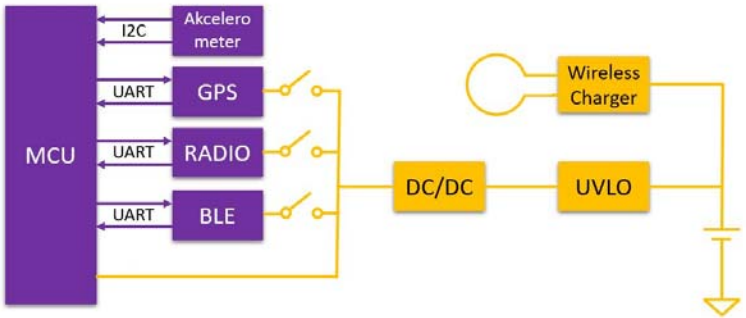


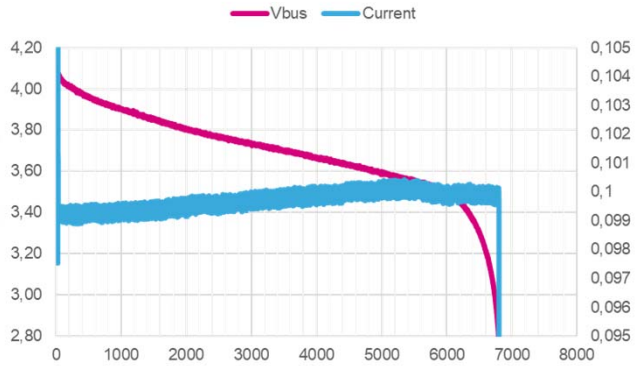


D7 - Power-management evaluation platform
Nano Design (SK); STUBA



- **Nano has finished first device for tracking small animals**
- **The device is now under evaluation (power consumption, GNSS localization precision, testing in real life scenarios, etc)**
- **This tracking device features LoRaWAN communication for sending tracking informations**
- **Bluetooth is used to detecting home or the owner**





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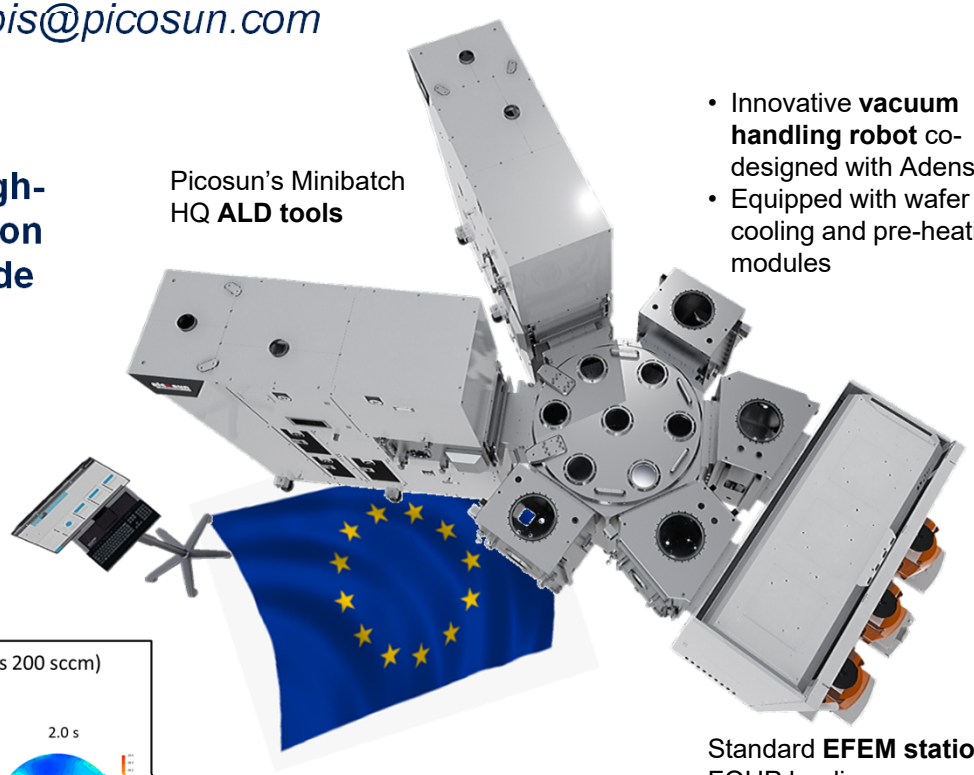
WP5
Equipment and Industry 4.0 Demonstrators

D8: New solutions for ALD at 300 mm Picosun (FI)

Romain Sibois
romain.sibois@picosun.com

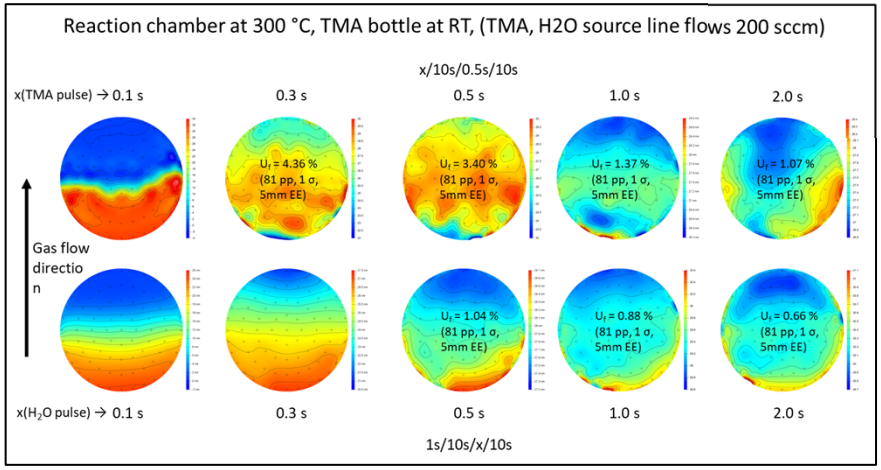
- **Picosun has developed a brand new high-quality ALD cluster tool for the deposition of high uniformity metal oxide and nitride films on batches of 300mm wafers (15 wafers/batch)**
- **The new tool is using latest Picosun proprietary reaction chamber design**

Picosun's Minibatch HQ **ALD tools**



- Innovative **vacuum handling robot** co-designed with Adenso
- Equipped with wafer cooling and pre-heating modules

Standard **EFEM station** for FOUP loading

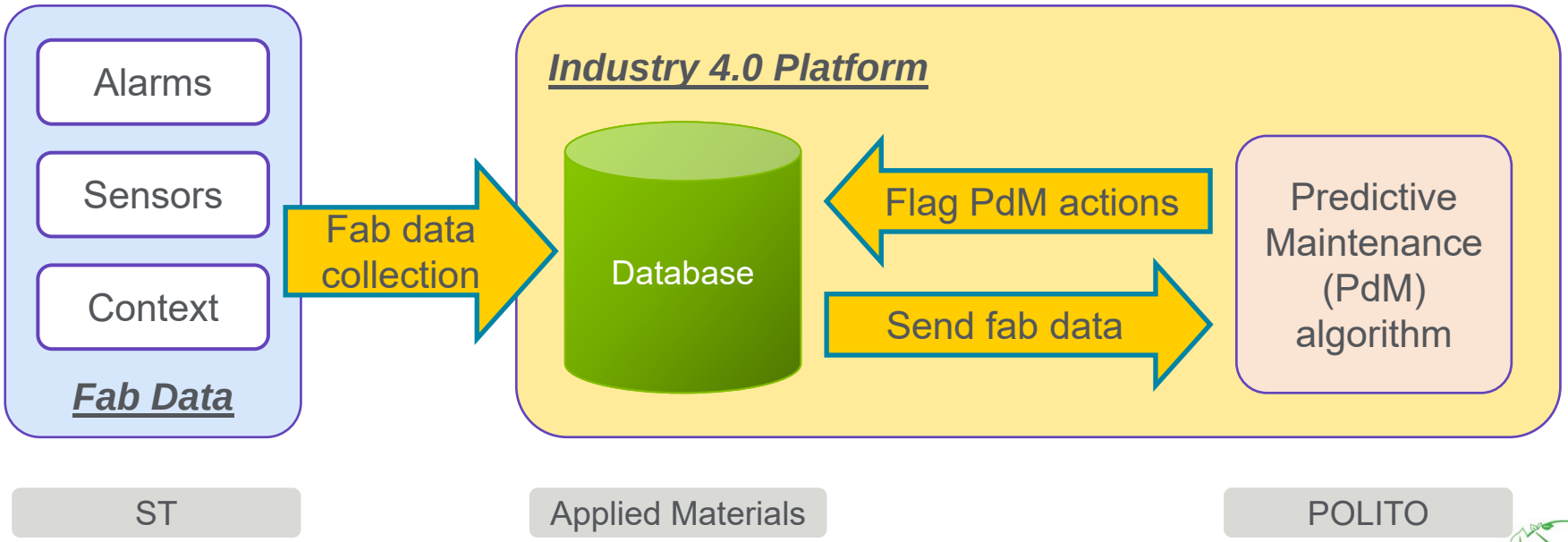


- **Preliminary results of the chamber behavior and respective deposition quality are extremely good and beyond the state of the art!**

D9.1 Pushing Industry 4.0 through the new Fab automation

AMIR (IL)

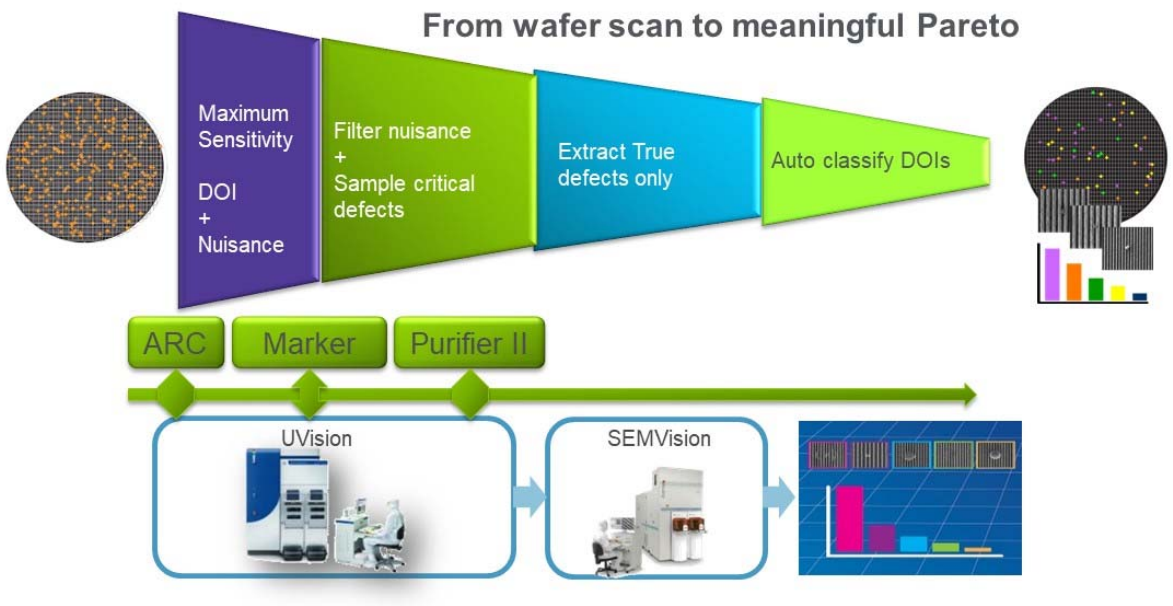
To demonstrate how to address future automation needs of semiconductor factories, D9 includes the demonstration of an Industry4.0 platform developed in WP2. This Industry4.0 platform integrates large amounts of factory data provided by ST from three sources (electrical wafer testing, Fault Detection and Classification sensors and tool alarms), and predictive maintenance algorithm(s) developed by POLITO.



D9.2 Rapid ramp allowing defectivity inspection and yield optimization AMIL (IL)

AMIL objectives

- **Introduce new features for inspection and defectivity during process development and production phases, in order to improve yield and productivity**
- **D9.2 includes demonstration of Marker, Purifier II and ARC features**



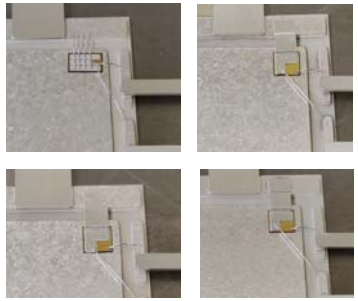
- **Marker:** optical inspection flow – higher sensitivity, lower Nuisance, shorter Time to Recipe
- **Purifier II:** faster and improved inspection filtering
- **ARC:** Automatic Recipe Creation for fast Product to Product recipe transfer; utilizing off-tool CAD capabilities for shorter time to recipe in order to improve productivity

D10. Packaging: advanced 3D System-in-Package APC (NL)

1. Die interconnect study

APC has studied and compared different interconnect materials/processes on a SiC die to demonstrate process robustness. Since SiC is unanimously considered more brittle and sensitive to mechanical failures compared to thin IGBT. Such results can be easily extended on IGBT's as well.

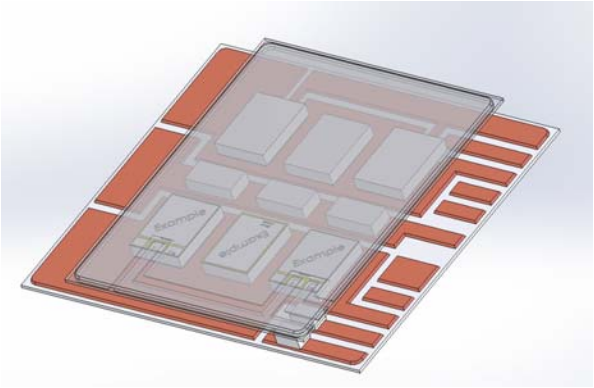
	Config #1	Config #2	Config #3	Config #4
AMB	Ag	Ag	Ag	Ag
Die type	SiC 1	SiC 2	SiC 2	SiC 2
D/A	Pressure Ag-sinter	Pressure Ag-sinter	Pressure Ag-sinter	Pressureless Ag-sinter
Clip	N/A	Solder preform	Pressure Ag-sinter	Pressureless Ag-sinter
Wirebond	Al wedge Source Al wedge gate	Al wedge gate	Al wedge gate	Al wedge gate



- **Result is that pressure sintering gives the best performance and process stability**

2. Package concept demonstrator

Double Side Cooled Power module > Fully pressure sinter connected interfaces / Epoxy molded



- **Demo 10 will have optimum Rth construction for high power requirements.**